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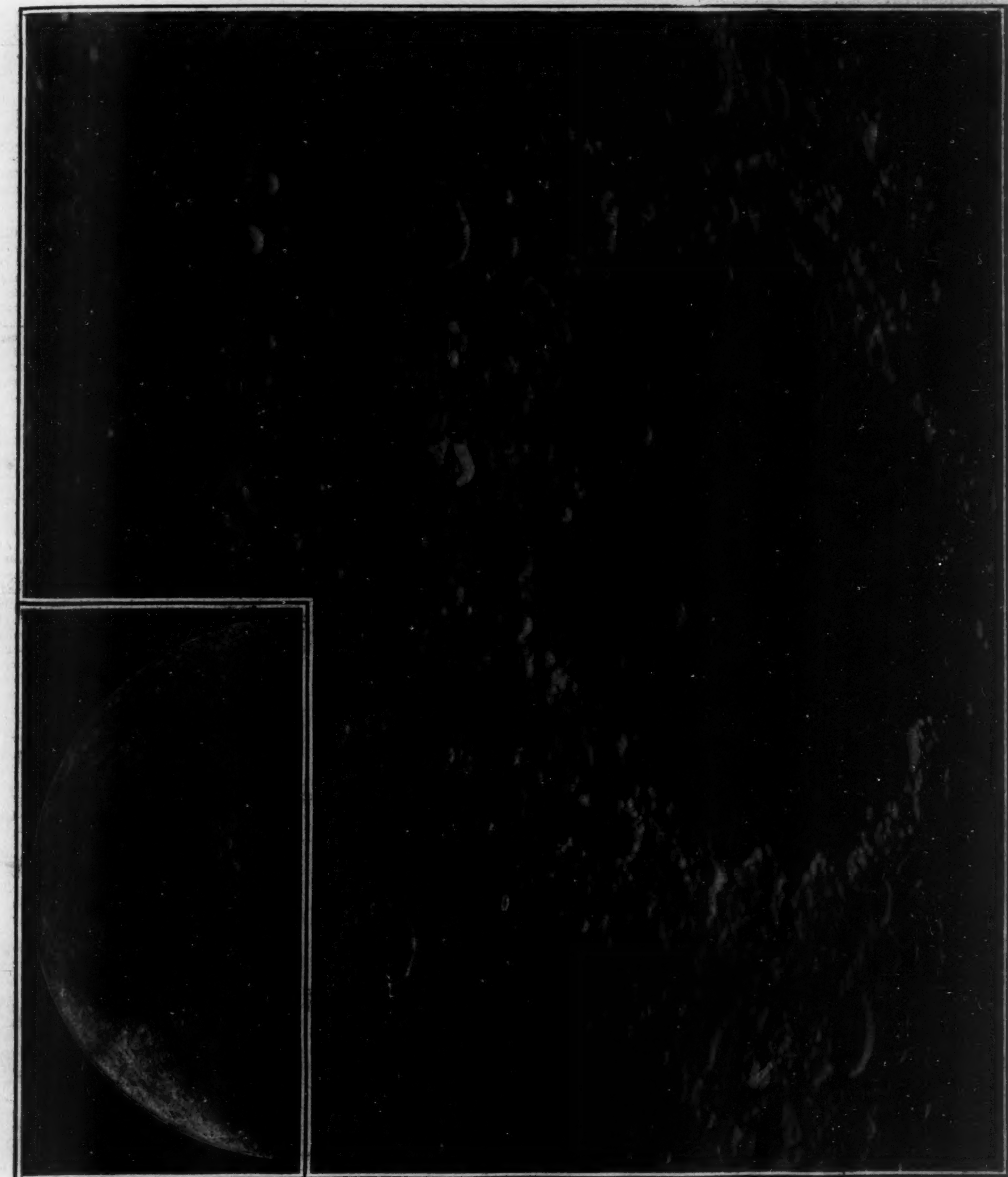

TWO PHOTOGRAPHS OF THE MOON TAKEN BY LOEWY AND PUISEUX WITH THE EQUATORIAL COUDÉ OF THE PARIS OBSERVATORY.—[See page 511.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, DECEMBER 23, 1905.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

LATEST SUCCESS OF THE MARINE TURBINE.

When the history of the development of the marine turbine comes to be written, that period of it which deals with the application of the turbine to the transatlantic steamship must ever be closely associated with the name of the Cunard Company, which was the first seriously to consider the application of the turbine to the transatlantic steamship. This occurred in the early autumn of 1903, when the company was negotiating with the British government for two steamships that were to be larger and faster than anything at that time afloat. An engineering commission was appointed to investigate the problem, and after researches lasting for more than half a year, they reported early in 1904 in favor of the turbine. Meanwhile, however, the company had determined to build two large steamships of smaller dimensions and lower speed than the vessels above referred to, and the contract for the first of these, the "Caronia," was placed with John Brown & Co. on the Clyde. In 1903 the same firm, when bidding for a duplicate of the "Caronia," submitted an alternative design to be driven by turbines instead of reciprocating engines, and the contract for the second vessel, the "Carmania," was duly closed early last year. About the same time the Allan Line had determined on the construction of the two turbine liners "Virginian" and "Victorian," both of which are now in service. The "Caronia" and "Carmania" have been completed, and both are now sailing in the regular service of the company, the "Carmania" having just made her first successful trip to the port of New York.

The two ships are sister vessels in every respect but that of the engines; they have been built by the same firm; they will sail over the same route, and, therefore, under the same average weather conditions. Hence they afford an ideal opportunity for testing the relative first cost, cost of operation, and all-around usefulness of the reciprocating engine and the turbine in work of this character. When the "Carmania" has spent six or eight months in service, and her turbine equipment has thoroughly worked down to its bearings, the question of the relative efficiency of the old and the new type of engine will be proved to an absolute demonstration, at least as far as the Parsons type of turbine is concerned.

At the present writing, it is sufficient to say that so far as the trial trips and the maiden voyage of the "Carmania" are a criterion, the application of the turbine to an ocean liner of the largest size has been a brilliant success, and thereby the last doubt as to the ability of the steam turbine to supersede the reciprocating engine in practically every class of marine service, from the torpedo boat up to the 40,000-ton high-speed ocean steamer, is completely set at rest. What the success of the "Carmania" implies to her owners can be understood, when it is remembered that upon her success depended the profitable outcome of the investment of about eighteen million dollars, of which thirteen millions represents the cost of the new 25-knot turbine liners now under construction.

The question of the availability of the turbine in the largest passenger steamships has involved the three-fold question of speed, comfort, and economy, the first two being all-important to the passenger, and the last to the operating company. As regards the question of speed, the "Caronia" on her trial maintained an average speed of 19.5 knots an hour, with 22,000 indicated horse-power, whereas the "Carmania" showed an average speed of 20.5 knots per hour, for which the equivalent horse-power would be 25,500. The "Carmania" had not been in drydock for eight months, and her bottom was necessarily foul. With a clean bottom, it is reasonable to suppose that she would have made fully 21 knots an hour. The turbines received a most severe test on the voyage to New York, for, with the exception of one day, the whole distance was run against heavy westerly gales, in which at times the ship was driving "bows under." In spite of this, the turbines, because of the deep immersion of their propellers, were absolutely free from racing, and there was a complete absence of either vertical or horizontal vibration. The deep immersion of the propellers is due largely to their small diameter, the tops of the propeller blades being fully 16 feet below the water at normal draft, whereas the tops of the blades of the "Caronia" are only 5 feet below the surface. Consequently, even when the vessel is plunging heavily, the tops of the blades are never brought above the surface; being at all times deeply immersed in comparatively still water, they are working under conditions that are highly favorable to efficiency, and are entirely protected against "racing" and the excessive vibration which accompanies it.

It will be understood that the chief cause of anxiety as regards the huge turbines of the "Carmania" was as to whether the great increase in size would introduce some elements of difficulty which had not been developed in the smaller turbines. Hitherto the largest single unit was the low-pressure turbines for the "Virginian" and "Victorian" of the Allan Line, each of which weighed 78 tons. Each low-pressure turbine on the "Carmania" weighs 340 tons, a truly enormous advance to make on a single engine. That no mechanical difficulties are feared in the operation of the 75,000-horse-power turbines of the new 25-knot ships is due to the fact that the low-pressure turbines that are being built for those ships will not exceed 425 tons in weight, an advance on the low-pressure turbines of the "Carmania" of only 25 per cent.

THE QUEST OF THE NORTHWEST PASSAGE.

Fraught with the romance and tragedy of the ice-bound desolation of the North, associated for nearly four centuries with the most persistent endeavors of voyagers of nearly all nations, and remaining unpenetrated and chimerical almost to the dawn of the present day, the quest of the Northwest Passage rivals the search for the Pole in the annals of Arctic exploration. The earlier attempts to locate this waterway to the fabled riches and splendor of the Orient were prompted solely by reasons of commercial expediency, for the purpose of finding the shortest route between Europe and Cathay; but the utter impracticability of this became evident to European minds when it was understood that America was not merely Tartary or some other geographical dependency of Asia. Curiously enough this belief obtained in the old world for nearly a century and a half, and during this period those memorable expeditions to locate a Northwest Passage were undertaken and executed with consummate daring and skill by English seamen. Upon the realization of the commercial futility of these desperate voyages, the attempt to circumnavigate the northern littoral of the American continent ceased for a period, and until the beginning of those explorations led by the worthier motive of adding to the store of human knowledge and scientific attainment, the conquest of the bleak polar regions halted. With the exception of the attempts to reach the pole itself, no Arctic goal has been so eagerly sought as the Northwest Passage; and while, it is true, many of the later voyagers attempted this feat merely as an incidental part of the general plan of geographic research, we undoubtedly can say the same of the many dashes for the pole which have been made.

There is to-day no question that the earliest discovery, exploration, and even settlement of America were due to the Norsemen, those unequaled seamen and rovers of the ninth and tenth centuries. Their flourishing maritime settlements on the coasts of Greenland existed over five hundred years before the first voyage of Columbus, and as they pursued their fishing expeditions as far as Lancaster Sound and even Barrow Strait, we can fairly conclude that the initial step toward the location of the Northwest Passage was due to these voyagers, though it is inconceivable that the purpose was other than the pursuit of their fisheries. The actual beginning of the series of searches with the Northwest Passage as objective, which began almost coincidentally with the expeditions of Columbus, must be ascribed to the first voyage in 1497 of the Cabots, who penetrated nearly half way up Davis Strait in an attempt to sail around the continent, and thus attain the land of Cathay. Little further progress was made until the expedition under the leadership of Martin Frobisher, who in 1576 to 1578 discovered the entrances to Frobisher and Hudson Straits, and made a few scientific investigations, the first, by the way, which we hear of in any of these voyages. A later voyage, by Sir Humphrey Gilbert, was without important results.

The first great advance, not only in the search for a northern waterway to India, but in general polar exploration as well, was made in the three voyages of John Davis, who in 1585 first fairly discovered the strait that to-day bears his name, reaching what is now Godthaab, Greenland. After an unsuccessful voyage in the following year, Davis in 1587 with reckless daring pushed on to latitude 72 deg. 12 min. in the neighborhood of Sanderson's Hope, on the west coast of Greenland. His remarkable journeys covered the west coast of Greenland from Cape Farewell to Sanderson's Hope, and the American coast from Labrador to Cumberland Island. William Baffin, another of that deathless race of medieval navigators, in the "Discovery," a tiny vessel of only 55 tons burden, reached the islands known under his name to-day, crossed Baffin Bay *via* the "Middle Passage," and in 1616 was in Smith's Sound in sight of Cape Alexander. Baffin's farthest north of 77 deg. 45 min. remained unequaled in this region for 236 years, and his voyage added materially to the geographical knowledge of Ellesmere and Prudhoe Lands, and Smith, Jones, and Lancaster Sounds. The two latter he cautiously entered, and found them completely obstructed by ice, so that on his return to England he declared his belief in the non-existence of a Northwest Passage. The explorers of this time, English, Danish, French, and Dutch, were stimulated in their efforts to discover the Northwest and Northeast Passages, by the power of Spain, who in her arrogance and pride as the mightiest nation of the age, maintained her grasp upon the traffic of the Atlantic and Indian Oceans to the exclusion of all others.

Perhaps the most illustrious of all the seekers for this illusive waterway was Henry Hudson, whose explorations were pursued between those of Davis and Baffin. After vain attempts under the auspices of the famous Muscovy Company to find a Northeast Passage between Greenland and Spitzbergen, and Spitzbergen and Nova Zembla, in 1607, 1608, and 1609, he turned westward in the last year, and sailing along the American coast discovered New York Bay and the Hudson River. The following year he again sailed far north along the coast, through the Hudson Strait and into the great bay that bears his name, penetrating westward several hundred miles farther than had hitherto been accomplished. After wintering in Hudson Bay and suffering severely from tempestuous weather and failing provisions, part of his expedition returned to England. Hudson himself, one of the most tragic figures in the history of the Arctic, had miserably perished, after being set adrift in a small boat by his mutinous crew. It was now believed that the way to the Pacific had been discovered, and that it undoubtedly lay through Hudson Bay. Within five years a number of expeditions were made into this vast sheet of water, and in these Fox Channel and Rowe's Welcome were explored. This belief in an outlet to the Northwest *via* Hudson Bay persisted nearly to the beginning of the 19th century, and the English Parliament as late as 1743 offered a reward of £20,000 to the crew who should first traverse this outlet. At this time, too, the Russians began their attempts to prove the existence of the passage by seeking to penetrate from the westward through Behring Strait and, in general, to explore the polar archipelago. Only bare mention can be made here of these explorers, of Behring, Shalaroff, who in 1760 died of starvation with his entire crew, of Andreyeff, Billings, and Von Wrangell and Anjou, the last two making their famous sledge journeys in 1820 to 1823. In 1776 Capt. Cook sailed on his last voyage in an attempt to penetrate the Polar Sea to the eastward through the Behring Strait, but was separated by a solid barrier of ice from a ship sent to await him in Baffin Bay.

By the end of the eighteenth century Arctic exploration had ceased to be undertaken merely in the interests of furthering commerce, and it had begun to assume importance from a purely scientific standpoint. The first of these expeditions, scientific in character, sailed in 1818 to discover the Northwest Passage by means of the great openings reported by Baffin to exist at the westward end of Baffin Bay. Under the command of John Ross the expedition penetrated Lancaster Strait for about 60 miles, and on meeting with heavy ice Ross came to the conclusion that the strait was merely a bay, and returned to England. Parry, a lieutenant under Ross, disagreed with this view, and in 1819 led an expedition to again attempt the Passage. Parry was undoubtedly one of the ablest explorers of his time, and his achievements were splendid. He traversed Lancaster Sound, Barrow Strait, Melville Sound, and Banks Strait, practically demonstrating, had he but known it, the existence of a waterway leading through the Parry Archipelago to the Arctic Ocean. The expedition wintered at Melville Island after exploring that vicinity. Parry's later expedition through Hudson Strait and Fox Channel was important in relation to the terrible land journeys of Franklin, 1819-22, and in the exploration of Repulse Bay and Melville Peninsula. Ross, who spent several years in the Arctic, and thoroughly explored Boothia, King William Land, and adjacent waterways, persisted in his belief that there was no Northwest Passage. Of importance was the location of the north magnetic pole near King William Land by his nephew, J. C. Ross.

The problem of the Northwest Passage was really solved by the ill-fated expedition under Sir John

Franklin, partly by its own efforts, but largely through the relief expeditions sent out later. The Franklin party, consisting of 129 men in two vessels, wintered at Beechy Island near the beginning of Barrow Strait in 1845, and in 1846 reached King William Land, where the ships were beset in the ice. From the only record found it was shown that a land expedition under Lieut. Gore had demonstrated unquestionably the existence of the Northwest Passage, but on the return of this party to the ships they found that Franklin himself with twenty-three men had died. The vessels were abandoned in 1848, and the remainder of the party perished in an attempt to reach the Fish River. The numerous search expeditions were very successful in exploring the American Arctic region from Greenland westward. Collinson, particularly, succeeded in navigating his ship, the "Enterprise," from Behring Strait to Cambridge Bay, Victoria Land, where he wintered safely, accomplishing his return the following year. During this time he had seen, though unknown to him, the sea wherein Franklin's ships had been destroyed, and had even picked up relics of that unfortunate expedition.

This brings us to the first actually accomplished Northwest, or rather Northeast Passage, made by M'Clure in 1850-54. In his vessel, the "Investigator," he reached Banks Land, which he explored as well as Prince Albert Land. After wintering there for three years he was finally forced to abandon his ship in Mercy Bay. Learning of a Franklin search expedition at Beechy Island, he managed to reach one of its ships, the "Resolute," by an extremely arduous sledge journey to the eastward, and was later taken to England through Lancaster Sound by the "Phœnix" of the same expedition. He thus completed the first passage from the Pacific to the Atlantic northward of America known to the history of mankind. M'Clure was undoubtedly the first of the great multitude of explorers to accomplish this feat, and while he had encountered continuous waterways for the entire distance, the journey was performed under such difficulty and hardship that until to-day no other navigator has attempted to equal it.

But the present year has seen inscribed on the pages of the Arctic's history the record of a journey which not only equals but far surpasses the remarkable trip of M'Clure. To Capt. Roand Amundsen, of Norway, belongs the honor of being the first actually to force his vessel through the historic Northwest Passage, traversing the northern shores of the continent from the Atlantic to the Pacific, and incidentally pursuing highly important scientific investigations which included the definite location of the north magnetic pole upon King William Land. To us the story of the Northwest Passage is more or less historical merely, for since the Franklin search expeditions, half a century ago, it has fallen rather into the background. The voyage of the Norwegian captain with a crew of seven men in his 46-ton sloop, the "Gjoa," is the final culmination of four centuries of toil, hardship, and suffering, and it gives to our matter-of-fact age an adventurous deed that forms a link between these prosaic times of steam and iron and that splendid period, crude in the seaman's art, but unequaled in enterprise and courage, which began with the discovery of America, and lasted for nearly three centuries.

THE ELECTRICAL SHOW AT THE GARDEN.

The annual exhibition of electrical devices and apparatus now running at Madison Square Garden was opened with great *éclat* on the night of December 12 last. A special wire connected the exposition with a golden key in the White House at Washington, and immediately after an address of welcome by Prof. Seaver of Columbia University, President Roosevelt, at a signal from the Garden, touched the key, lighting the numberless lamps and setting the machinery in motion. A presidential salute of twenty-one guns was thereupon fired from the Garden tower to proclaim the official opening. In many respects the exhibition this year is a disappointment. It shows very little that is really new. The theaterphone exhibited by the New York Telephone Company has probably attracted the greatest popular interest. A number of telephone receivers are connected with three New York theaters, so that visitors at the Garden can follow the conversation and music of the various performances. The theter transmitter, which is still in an experimental stage, operates on the same principle as the ordinary transmitter, except that the diaphragm is made of wood instead of metal. In this way the metallic sound of the ordinary receiver is avoided, and a much sweeter tone is secured, which is particularly noticeable in the reproduction of orchestra music. No horn is used on the transmitter, as it is desirable to avoid all false or superposed vibrations. Even in its present unfinished condition remarkable results have been obtained, and the time may soon come when one can attend any performance or concert within reach of his wire without leaving his comfortable library chair.

A new electric elevator deserves more than passing comment. A large drum below the floor of the elevator is turned by an electric motor under control of the elevator operator. A spiral rib is formed on the face of the drum, and this engages two racks on opposite sides of the elevator shaft. Thus, the elevator feeds itself up or down according to the direction of rotation of the spiral. To relieve the friction the rack is formed with a series of rollers in place of fixed teeth. The main advantage of this system lies in the safety of the elevator; for no matter if the power should suddenly give out, the elevator will not drop, owing to the low pitch of the spiral rib. The construction also affords a considerable economy of power.

The subject of individual motor drive of machine tools and other machinery, which is just now arousing so much interest in the mechanical world, is represented by a number of variable-speed motors, which claim high efficiency under extreme conditions. Considerable interest centers in the Poulsen telegraphone, which was described in our columns two years ago. This instrument, it will be recalled, automatically receives and records telephone messages on a steel wire. This record may be read at any time by running the wire through the transmitter of the machine. One of the oddities, though by no means a novelty, is the electric clock system, in which a single master clock operates electrically all the clocks of a building, district, or entire city. The master clock is operated by weights, and at the end of each minute sends an impulse through the circuit which correspondingly moves every clock hand in the entire system. Thus perfect accuracy is maintained. No batteries are used in the circuit, but the electrical impulse is produced inductively by the movement of an armature through a magnetic field. In this way sparking at contacts is avoided.

The man who has not kept up-to-date on the subject of electricity in the household will find much of interest in this department of the exhibition. Complete kitchen equipments, including every variety of electrically-heated utensil from a tea kettle to a griddle, are shown. The household devices also cover a vast number of novelties ranging from sad irons, milk warmers, curling irons to electric heating pads which are used in place of hot-water bags. In contrast to these heating devices may be mentioned the small ice-making plants which are operated by electric motors. These are suitable for small stores which carry perishable goods. A number of medical apparatus and appliances are shown, such as vibrators and the like. Other features of the exhibition are wireless telegraphy, the mercury vapor light and converter, flaming-arc lamps, and various high-tension apparatus.

THE DEATH OF EDWARD ATKINSON.

Edward Atkinson, the well-known social and political economist, of Boston, died suddenly on December 12. He was seventy-eight years old.

His education was secured in private schools and by his own efforts; his life, after the age of fifteen, being devoted to what he termed "work in a practical way."

After an extended experience in various branches of cotton manufacture he became interested in mutual insurance for manufacturers, and in 1878 was made president of the Boston Manufacturers' Mutual Fire Insurance Company, which he aided in establishing. He devoted much energy to the study of the prevention of loss by fire and the reduction of the cost of insuring, making an especial study of construction, occupation, and apparatus, the special hazards of textile factories, paper mills, cordage factories and machine shops, and the safeguards to make them better risks.

He regarded his invention of the "Aladdin Oven," a device for cheapening and simplifying cooking, as his chief life work, and the one designed to do most to carry down his name as a benefactor of the race. He gave the invention to the public freely, without patenting it. The efforts to push it were never especially successful.

As a pamphleteer Mr. Atkinson was prolific, and he contributed at various times to many magazines and newspapers. Among his published works are "The Distribution of Products," "The Industrial Progress of the Nation," "The Science of Nutrition," "The Margin of Profit," "Taxation and Work," "The Prevention of Loss by Fire."

THE PATENT OFFICE.

The report of the Commissioner of Patents on the business of the Patent Office for the fiscal year ended June 30, 1905, shows that there were received during that year 52,323 applications for letters patent, 749 applications for designs, 174 applications for reissues, 1,846 caveats, 11,298 applications for trade-marks, 1,236 applications for labels, and 448 applications for prints. There were 30,266 patents granted, including reissues and designs; and 1,426 trade-marks, 1,028 labels, and 345 prints were registered. The number of patents that expired was 19,567. The number of allowed applications which were, by operation of law, forfeited for non-payment of the final fees was 5,154.

The total receipts of the office were $1,737,334.44, the total expenditures were $1,472,467.51, and the surplus of receipts over expenditures, being the amount turned into the Treasury, was $264,866.93.

The Commissioner states that the new trade-mark law of February 20, 1905, which took effect April 1, has caused an enormous increase in the trade-mark work of the Patent Office. The first three months that the law was in operation 9,710 applications for registration of trade-marks were filed, and it is apparent that the office will need to increase largely the force engaged on this work. Already the division of trade-marks has required the assistance of examiners and clerks detailed from other divisions from which they could ill be spared.

The Commissioner calls attention to the importance of the work of classifying patents, which is essential to the proper examination of applications, and invites attention to the necessity for an increase of force for this purpose. He states further that in view of the increased volume of work in the office, and its expected growth, there should be a corresponding increase in the number of employés and in the space provided for the transaction of the business, in neither of which particulars are the necessities of the office adequately supplied at the present time.

SCIENCE NOTES.

M. P. de Wilde, professor at the University of Brussels, has taken up the study of the gold which is contained in sea-water. He proposes a new method of extracting it. A ton of sea water is treated with 4 or 5 cubic centimeters of an acid and concentrated solution of chloride of tin. The whole of the gold is thus concentrated in the complex body known as purple of Cassius, which contains gold, tin and oxygen. It is found that the purple body is fixed very strongly upon the flaky hydrate of magnesium which is set free in sea water when we pour in lime water. The hydrate falls to the bottom with the gold attached to it. The gold is set free by a cyanide of potassium solution (about 1 in 2,000) thus forming a cyanide of gold. The metal can then be extracted by a number of well-known methods. Liversedge shows that when sea water is sent in casks, the wood causes the gold to precipitate, and thus none is found in the water. M. de Wilde made experiments at the seashore in France on the west coast and found traces of gold in the water. He considers that much of the gold is thrown down to the sea bottom, and thus it escapes us. It will be remembered that Liversedge, professor at the University of Sydney, found from ½ to 1 grain of gold per ton of sea water from the coast of New South Wales.

From time to time we hear of experiments made upon the effects which certain colors seem to have upon the human organism. A recent contribution to this subject comes from Prof. Redard, of Geneva, who has been making researches with a view of using the physiological effects of colored light in surgery. At the Swiss Dental Congress he described a new anæsthetic effect which is based upon the influence of the blue rays upon the nervous centers. A number of experiments showed him that he could obtain a deadening of the nerves which was sufficient to allow of making some local operations of short duration. According to Prof. Redard, each of the primary colors has a special and well-defined action on the organism. Red light is an exciting and an irritating agent. We are aware of its action in modifying the virulence of certain eruptions and how it has been applied in the variole. Yellow light seems to have a depressing action, while with blue light we obtain a sensation of calm and ease. To apply the anæsthetic method with blue light, the patient is seated on a chair at 10 inches from a 15-candle-power incandescent lamp. The bulb of the lamp is of blue glass and it has a nickeled reflector. The head is covered with a thin blue veil and the patient directs his vision toward the lamp. After a few minutes the subject is found to be in an unconscious state, and on lifting up the veil we find that the pupil is dilated and the regard fixed. In this state a tooth can be extracted or other short operation carried out without pain. However, it must be understood that the effect succeeds better with some subjects than with others. Dr. Milliard, of London, used blue light for the same purpose. In twenty cases the success was complete. In eight others it did not succeed. The effect is not attributed to hypnotism, but to the direct action of the rays upon the nerve centers.

Limestone Island is the center of the New Zealand cement industry. It is about 100 square miles in area, and is wholly composed of hydraulic limestones. It was reported on originally by Sir James Hector for the New Zealand government as an island of hydraulic limestone of a quantity practically unlimited, and estimated to contain over 30,000,000 tons above water level. Beneath the limestone there is believed to be coal, and for this borings are now going on.

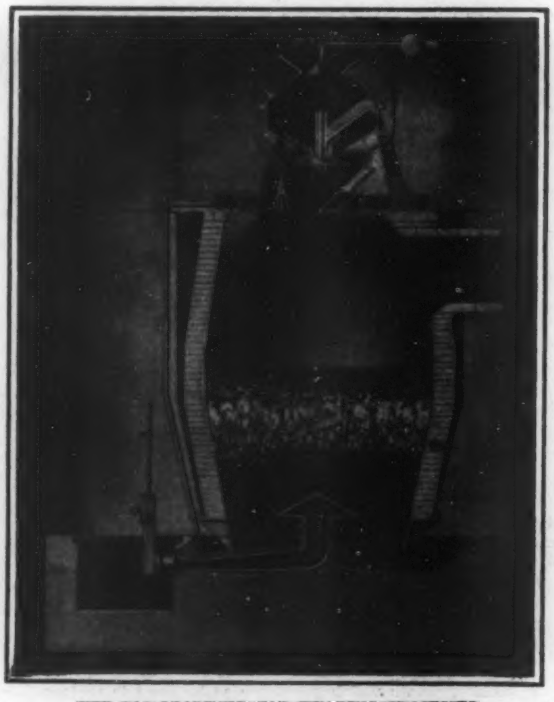
OFFICIAL TRIALS OF THE BATTLESHIP "RHODE ISLAND."

The unusual rapidity with which the "Louisiana" and "Connecticut" have been built, and the delay due to delayed armor plate and other causes in completing the ships of the "Georgia" class, have conspired to render the present fiscal year a most remarkable one in respect of the number of first-class battleships that will be completed within the twelve months. By June 30, 1906, the five battleships of the "Georgia" class, authorized in 1899 and 1900, and the battleships "Connecticut" and "Louisiana," authorized in 1902, will have been completed, and it is possible that the whole seven will have gone into commission within the brief period of six months. In the "Georgia" class are the "Georgia," "Nebraska," "New Jersey," "Rhode Island," and the "Virginia." The "Georgia" is building at the Bath Iron Works, the "Nebraska" at Moran Brothers, Seattle, the "New Jersey" and "Rhode Island" at the Fore River Works, Quincy, Mass., and the "Virginia" at Newport News. These five ships have as their distinguishing characteristic a pair of double-deck or superimposed turrets, one forward and one aft, with a pair of 12-inch guns on the lower deck and a pair of 8-inch guns on the upper deck of each turret. A little forward of amidships on each beam is an 8-inch turret, carrying a pair of 8-inch guns. In addition there is a battery of 6-inch guns carried in broadside on the gun deck, and a battery of twelve 3-inch, twelve 3-pounders, and eighteen smaller guns, placed in various points of vantage throughout the ship.

The superimposed turret is the only feature about these fine battleships that is open to criticism, and it formed the subject of a lengthy controversy in the Naval Board on Construction, at the time these designs were adopted. The principal objection against this method of mounting was that it crowded too many guns into a single emplacement, and rendered four guns of the main battery liable to be put out of action by one successful shot. It is probable that the events of the Russo-Japanese war have tended rather to weaken the force of this argument; for the heavily armored turrets, and, indeed, the turrets of even the secondary batteries, appear to have come through the ordeal most successfully, not a single case, we believe, having been recorded of absolute penetration or permanent disablement of a turret. There is more force, probably, in the objection urged against the double turret, on the ground that, when more than one gun is mounted in a single turret, the guns have to wait upon each other in their order of firing. Of course, in a four-gun turret, this incidental delay would be greater than in one carrying two guns or one gun. The advantages of the double turret are that it admits of a great concentration of fire, and that there is a considerable saving in weights. Thus, as compared with the later ships of the "Connecticut" class, the "Georgia" class can concentrate two 12's and six 8's ahead or astern, and four 12's and six 8's on the broadside, whereas the larger "Connecticut" can concentrate two 12's and four 8's ahead and astern, and four 12's and four 8's on the broadside—a clear gain for the superimposed turret of a pair of 8's on every point of fire.

The "Rhode Island" and her sisters are well protected, Krupp armor being employed throughout. The belt has a maximum thickness of 11 inches; the 12-inch turrets have a maximum protection of 12 inches, and the 8-inch turrets of 8 inches of armor. The armored deck varies in thickness from 1½ to 3 inches. The vessels are 435 feet long by 76 feet 2½ inches in beam, and on a mean draft of 23 feet 9 inches they displace just under 15,000 tons. The coal supply of 1,705 tons is considerably less than that of the "Connecticut," and the steaming radius at 10 knots is 3,825 knots, which compares rather unfavorably with the 5,000 knots of the "Maine" and the "Connecticut."

However, it is impossible, upon a given displacement, to bring every element of power and efficiency up to the highest standard; what the "Rhode Island" and her sisters lack in coal capacity and radius of action, they gain in their great battery power, their excellent armor protection, and their high speed of 19 knots an hour, which, if we may take the "Rhode Island" as a criterion, is likely to be exceeded in all the vessels of this class. The "Rhode Island" was taken out on the government course on November 11 to undergo a four-hour standardization trial, during which it was found that with an average number of revolutions of 125.86 per minute she averaged, for the four hours, a speed of 19.01 knots per hour. In the turning trials it was found that it took 10 1-5 seconds to put the helm hard a-starboard, and the vessel occupied 3 minutes and 30 seconds in steaming through a complete circle; that it took 19 3-5 seconds to put the helm from hard a-starboard to hard a-port, and that the time to complete the circle was 4 minutes and 25 seconds. By the courtesy of the builders of the vessel, we are enabled to present the accompanying view showing the "Rhode Island" when she was steaming at her full speed of over 19 knots an hour during the standardization trials.



THE GAS PRODUCER FOR HEATING PROCESSES.

THE GAS PRODUCER FOR HEATING PROCESSES.

BY WILLIAM B. CHAPMAN.

The early discussions, in England and Europe, of producer gas or "poor" gas, as it was called, awakened but little interest in this country. Our coal supply was generous, and the price of fuel comparatively low; moreover, just at that time the great possibilities of natural gas were discovered, and aroused so much enthusiastic interest, that little thought was given to any other form of fuel. Gas producers were looked upon by American manufacturers as unnecessary and of questionable economy. More than that, the producers themselves were designed in such small sizes that the American, using only large units in his processes, failed to recognize the possibilities of the new gas.

Nature was so prodigal of her gifts in this country, that men saw at first no need of economy in their use. In time, however, it became apparent that the supply of natural gas was not unlimited, but that, at the rate it was being used, the end would eventually be reached.

The advantages of a gas fuel had by this time been learned: its cleanliness, its controllability, its power, and its economy. Manufacturers not in the natural gas region had begun to ask if any form of gaseous fuel could be found, which would enable them to meet the competition of cheap natural gas; and when it was seen that the failing natural gas supply might compel a return to coal and wood as the only means of producing heat, the attitude of America toward the gas producer was entirely changed.

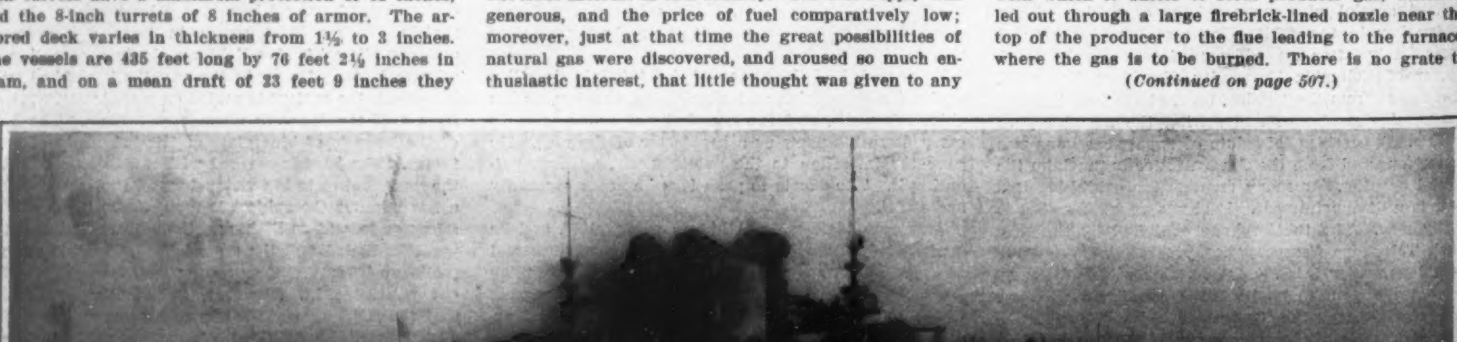
Finding here a subject worthy of their attention, American engineers thoroughly investigated English and European methods, and then began experimenting, to see if they could devise a producer that would meet the needs of the American manufacturer. Instead of devoting their energies to improving the details of small producers, as was being done on the Continent, they turned their attention to devising producers of increased capacity, and with an automatic feed device which would allow the producer to be run both continuously and uniformly. These efforts resulted in the development of producers of larger capacities than had been thought possible. Other improvements have been added, until at least one American gas producer has reached such a high state of efficiency that not only are American manufacturers becoming aroused to its merits, but numerous European firms are ordering it in preference to the cheaper producers made at home.

In many localities a prejudice exists against the gas producer, due to the failure of some particular make, designed and put upon the market by a boiler maker or machinist lacking the necessary engineering knowledge and experience. It is a mistake, however, to refuse to investigate this subject because of the blunders of some. The designing of a gas producer, and the adaptation of producer gas to various heating operations, are problems which so far have only been successfully accomplished by engineering companies having wide experience in many forms of heating operations. The manufacture and installation of gas producers is a business which, like the steam turbine or other great innovation, requires much special knowledge, and during its infancy must necessarily be limited to those having special facilities for obtaining the necessary experience.

The best type of American gas producer may be briefly described as follows:

An upright cylindrical steel shell, 10 to 14 feet in diameter, and of about the same height, slightly tapering at the base, lined with firebrick. In this is kept a bed of ashes at the bottom, two or three feet deep, and above a layer of partially-burned coal of about the same depth. A forced draft of air and steam of the proper proportion is admitted into the bottom of the producer through a large spreader or hood and passes up through the ashes and incandescent coal or carbon, with which it unites to form producer gas, which is led out through a large firebrick-lined nozzle near the top of the producer to the flue leading to the furnace, where the gas is to be burned. There is no grate to

(*Continued on page 507.*)



Displacement, 14,948 tons. **Speed,** 19.01 knots, **Maximum Coal Supply,** 1705 tons **Armor:** Belt, 11 inches; deck, 1½ to 3 inches; turrets, 12 to 6 inches, **Armament:** Four 12-inch, eight 8-inch, twelve 3-inch, twelve 3-pounders, eighteen small guns. **Torpedo Tubes,** four submerged.

BATTLESHIP "RHODE ISLAND" AT 19 KNOTS SPEED ON HER TRIAL TRIP.

THE NEW PHILADELPHIA SUBWAY.

BY J. A. STEWART.

Subway construction has been going on steadily in the large, congested cities of the United States. Its latest enterprise is the new combined underground and elevated street railway opened on December 21, 1905, in Philadelphia, although still incomplete in minor details.

It was the problem of modern urban life—congestion at the central arteries of traffic—which first gave the subway idea its vogue in this country. Boston adopted it with a success that not only gave great prestige to the system of underground transit, but also splendidly exploited the best ideals of municipal administration and ownership of public utilities. New York and Chicago have both demonstrated the value of the subway model in amelioration of the problem of adequate transit facilities. In all cases, it is to be noted, the subway does not claim to be a cure, but it has unquestionably proved to be an effective palliative.

When the far-sighted William Penn laid out the streets of his embryo western metropolis on the banks of the Delaware, he thoughtfully decreed that there should be broad, central thoroughfares at right angles running through and from the center of the city. But even the forethought and wisdom of Penn had not anticipated the needs of the twentieth century Philadelphia. The buildings have stretched toward the sky and far toward the horizon on every side, to accommodate the growth of population. The surface cars, which run on every street in the business part of the city, have long been inadequate for the full tide of traffic. So a subway has been resorted to.

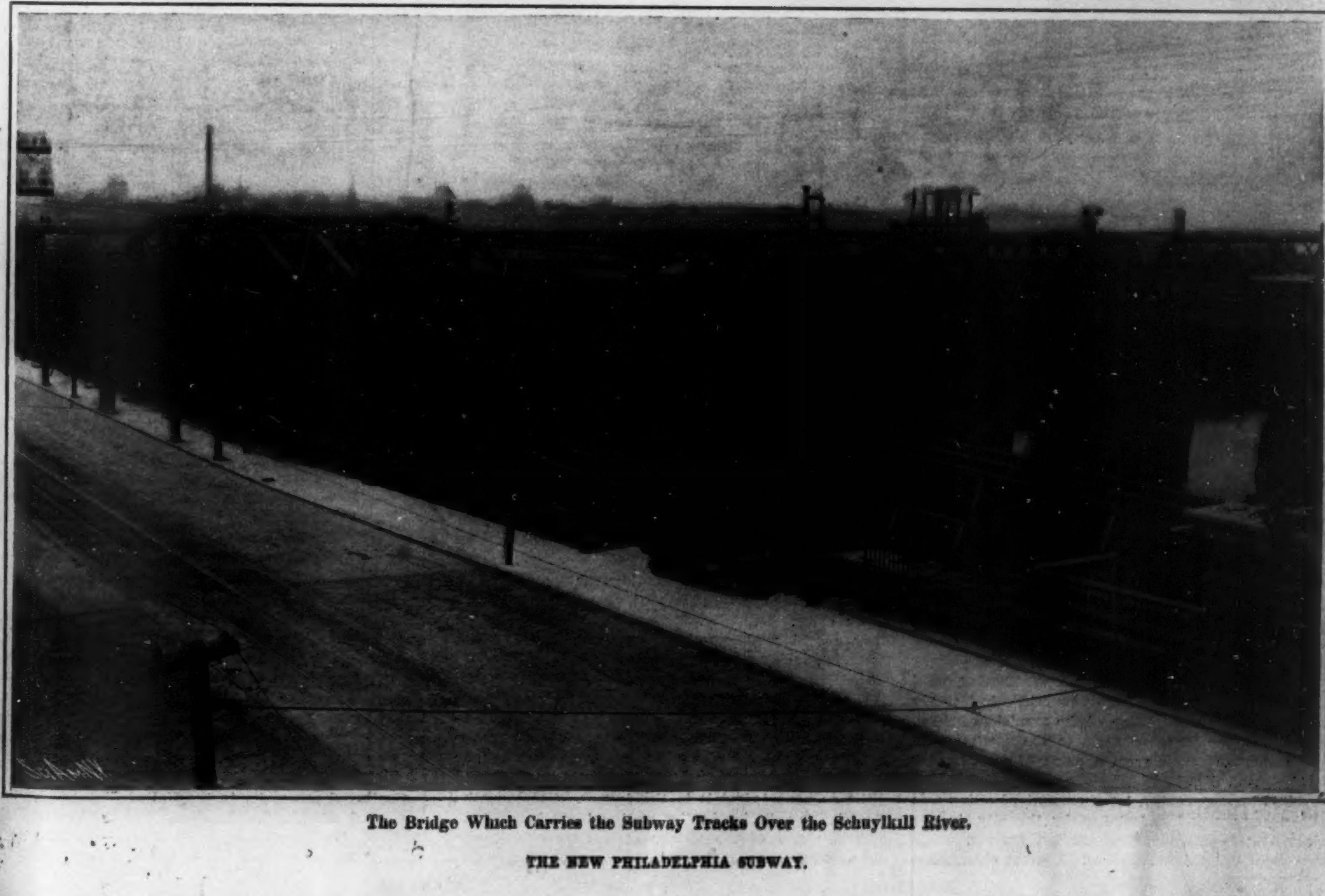
In planning the construction of their extensive operation, the Philadelphia Transit Company's engineers have had the invaluable help of the experience gained from the Boston and New York enterprises. The general approved plans of subway and elevated construction have been taken, with adaptation to local needs and conditions. The work has reached a point where it is appropriate to review and to record its revealed results.

The subway scheme in Philadel-

The New Philadelphia Subway Under Market Street Looking Toward the Portal.

The West Philadelphia Elevated Structure in Process of Erection.

Construction Work on the Line of the Philadelphia Subway.



The Bridge Which Carries the Subway Tracks Over the Schuylkill River.

THE NEW PHILADELPHIA SUBWAY.

phia involves, in outline, a tunnel under Market Street from river to river, encircling the city hall; an inclined bridge over the Schuylkill River, and an elevated road to the city line in West Philadelphia. In addition, an elevated road is projected on Delaware Avenue from South to Market Streets; and a subway under Broad Street. All the plans have been made by local engineers, and the work is directed by William S. Twining, as chief engineer; Charles M. Mills, first assistant general engineer of the subway and elevated road construction, and by Frank L. Fisher, engineer of subway construction. The total outlay involved is estimated at twelve million dollars.

Work on the subway was begun April, 1903. For the first twelve months progress was slow, as all the material had to be assembled, and the men instructed in their work. The portion of the operation first instituted—that on Market Street east from the Schuylkill to the city hall—presented no uncommonly difficult engineering problems. There were the usual pipes, sewers, and many other obstructions to contend with. The conditions imposed by the city ordinance that the streets be kept open for traffic were faithfully observed. The earth has been taken out of the north side, without disturbing the street surface. The method employed has been to brace the roof of the excavation, temporarily, with timbers and planking, digging in and upward till the rails on which the surface street car tracks rest were reached. The ironwork and concrete to form the permanent roof of the tunnel at from four to six feet below the surface were put in. Then the dirt was put back, and washed into place with water.

Cast-iron tubes are used in the Glasgow district railway tunnels and in the London underground. The masonry arch was adopted by that model of construction, the Chemin de Fer de Sceaux of Paris. In both Boston and New York, the subway engineers united the best qualities of the foreign construction in the combined masonry and steelwork type. This style of structure has also been adopted by the engineers of the Philadelphia subway.

The general plan of construction in Philadelphia is a four-track, concrete-lined tunnel with the four tracks on one level. It is a roomy structure 14½ feet high, 48⅓ feet wide, with slightly sloping roof.

In the Philadelphia work, the framework is formed of steel posts set 5 to 5½ feet apart at each side, with steel roof beams across the top. The roof beams extend 16 inches into the sides, being held in place by the concrete of the side walls. The roof and floor are also of concrete, the latter from 1½ to 2 feet in thickness. The side walls, which are 3 feet 5½ inches thick, are reinforced by vertical and horizontal rods and waterproofed by Cerion waterproofing on layers of burlap, finished by 8 inches of concrete. The roof is waterproofed with asphalt mastic covered for protection with 3 inches of concrete. The south wall carries terra-cotta ducts for city pipes.

The roof beams were made in three sections. The sections at either side are the width of one track span, and the center section the width of the two center track spans. When the excavation was completed, the center line of columns was erected, the roof beams were riveted to them and spliced together; then the concrete of the roof was added.

Ventilation chambers have been built in the side walls, in which fans may be installed if necessary. A special ventilating plant has been constructed at Twenty-second Street to relieve the subway of the noxious gases from the large city gas tanks at this point. This chamber has an opening 7 feet by 18½ feet, and is connected by a horizontal duct 8 feet square with a stack 60 feet high.

Drainage facilities are supplied by lines of 12-inch terra-cotta pipe under each track with sumps at regular intervals, the water being carried to a sump at Twenty-second Street, whence it is pumped into city sewers.

The most interesting feature of the new transit enterprise is the plan for crossing the Schuylkill. Instead of tunneling under the river, as has been done at Liverpool, New York, and Boston; or building an elevated superstructure over the present Market Street bridge, which was found unequal to sustain the burden that would have been imposed, the Philadelphia engineers determined to build, at a cost of over one million dollars, a new iron extension spanning the Schuylkill. Incidentally this has left the present bridge free for surface cars, and it has facilitated rapid transit. The center line of the new bridge is just 100 feet north of the central line of the municipal bridge. To reach it, the tunnel deflects to the north on reverse transition curves from a point 47 feet west of Twenty-second Street.

By this arrangement, a large amount of filling was made necessary and undertaken by the city, in the vicinity of Twenty-third and Market Streets, using the subway excavation material. A great change has been effected by the grading thus accomplished on the north side of Market Street, on the east bank of the Schuylkill. A new plaza has been created, with an iron railing, providing a vantage point from which passersby may overlook the traffic at the west portal of the subway.

Emerging from the tunnel at this point, the express trains gain grade with sufficient rapidity on the inclined bridge by which they cross the river to bring them out above the surface at the other side. From that point westward they are elevated. The other two tracks rise to the surface only when they cross the river, and will then follow the surface lines as at present.

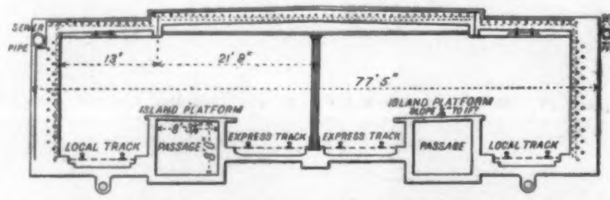
In the construction of the subway, every precaution has been taken to insure the safety of the heavy walls of the Broad Street station train-shed. They have been carefully shored as the work progressed, and despite the wet weather they have remained intact.

The building of the subway about the city hall involved considerable fine engineering and heavy expense. It is expected that three million dollars will be spent. The plans provide for a double-deck two-tracked tunnel that will form a loop about the municipal buildings. The base of the lower tunnel is placed more than 40 feet below the surface of the street. The lower tunnel will be used for the proposed Broad Street subway, and the upper one for Market Street.

As shown in the accompanying diagram, the two outer tracks will be for local trains, and the two inner tracks, indicated in the diagram by heavy lines, for express trains. The local tracks are depressed to pass under the express tracks, meeting each other again to form a loop.

The presence of quicksand in Filbert Street is one of the most difficult obstacles to be overcome in the construction of this section, which will all be done in open cut. Electric engines will be used by the contractors.

Probably the most interesting development in subway construction which the Philadelphia operation will display will be seen in the stations, especially in that at the new Wanamaker store, Market Street and Thirteenth. None like it has hitherto been conceived. Practically the whole Market Street frontage from Juniper to Thirteenth Streets has been given up to it. The station is 350 feet in length. It will be built of reinforced concrete, finished in white tile, with ample heat, light, and ventilating apparatus. There will be cross tunnels beneath, and underground entrances to adjoining mercantile establishments. The plans for the station include show windows 30 feet underground, which will be used by enterprising merchants to display their wares.



SECTION OF PHILADELPHIA SUBWAY AT THE FIFTEENTH STREET STATION.

To supply the requisite power for the operation of the new transit system has made necessary the construction of a great power house, one of the largest ever erected. The building, which is located at Delaware Avenue and Poplar Street, is 200 x 10? feet and three stories high, of stone and brick with steel frame. A battery of thirty-two boilers will be installed, and power will be supplied to the congested district as well as to the subway and elevated line. The cost of the structure and equipment is estimated at $1,500,000.

Taken altogether, when the present comprehensive projects shall have been completed, it is evident that Philadelphia will have made a good beginning in provisions for modern rapid-transit facilities.

Erratum.

In our issue of December 2, 1905, there appeared on page 438 an article by Dr. Myron Metzenbaum, on "Some Effects of Alternating Currents on Dogs," in which it was suggested that workers exposed to the danger of strong currents should wear a corset made of some non-conducting material, such as rubber. This is an error. What Dr. Metzenbaum meant was that they should wear corsets made of some conducting material, such as copper.

A writer in Power states that if there is any place on the ordinary steam engine where the ignorant factor of safety is overdone—surplus iron and strength—it is in the pillow-blocks and never in the flywheel, as it costs much money to get it in the latter place, and little or none to get it in the former. Consequently, America is suffering by the continual wreckage of flywheels. Most of the wrecks of the above character are of wheels operated by single or tandem engines

The Largest Private Electric Plant in the World.

There is at present nearing completion in New York city the largest strictly private electrical plant in the world. This plant, situated in the basement of the Mutual Life Building, and designed to furnish light and power to the entire city square occupied by the company and its tenants, consists of four 600 horse-power Watts-Campbell Corliss engines and four 350-kilowatt 110-volt generators. The engines and generators are joined by marine couplings, the only strain on which is torsional, the shaft being supported on bearings. Each armature and flywheel also rests on its own shaft supported between two bearings. This arrangement allows of disassembling any engines or generators without in any way interfering with the other portions of the unit. The engines are of the Tangye or heavy "rolling-mill frame" type, supplied with Corliss valve-gear. The generators are supplied with a special feature in the form of an automatic brush-shifting device which moves the brushes back and forth across the face of the commutator, thus eliminating the possibility of wearing ridges. This plant is designed to replace the old Mutual Life equipment of four 100 kilowatt Siemens & Halske generators, direct coupled to straight-line engines, which equipment is destined for the company's Broadway building. The work of installation began about a year ago with the removal of the old boilers, originally supplying steam to the Mutual Life Buildings. The present boilers are designed to furnish steam at 300 pounds pressure, if necessary.

The foundations had to be specially constructed, the location of the new units being limited to the space occupied as a court between the various buildings. The difficulty of constructing the foundations was enhanced by the fact that the concrete slabs, supporting the structural steel columns of the buildings' framework, rested on sand which had to be excavated from between the columns with the greatest care. A sufficient space having been cleared out, beams were laid down to form a closely-bolted network, concrete was poured on and about them to fill in the entire excavation, and the various units of the plant were bolted securely to this firmly knit mass. The plant is designed to operate 20,000 incandescent lamps, ten or twelve electric elevators, eight motors of from 2 to 6 horse-power, including an electric pump, and six blowers, with fans ranging from 36 to 60 inches diameter. Two of the units are now successfully operating, and it is planned to have the other two at work in a short time.

That the size of warships is rapidly increasing is common knowledge, but the extent of the average increase is by no means so well known. The number of warships of 12,000 tons displacement or over built and building for the several naval powers July 1, 1899, was 77, of which 46, or 60 per cent, belonged to the English navy. In 1900 the number was 94 (British 48, or 51 per cent); in 1902 there were 101 (British 53, or 52 per cent); in 1903, 139 (British 64, or 46 per cent); in 1904, 155 (British 70, or 45 per cent.); in 1905, 153 (British still 70, or 47 per cent). It will be noted that the falling off this year was due to the loss of a number of Russian ships. The number owned by the United States increased from 9 in 1899 to 14 in 1902, 23 in 1903, 26 in 1904 and 28 in 1905. In the last year France is credited with 15, Italy with 11, Germany and Japan with 10 each and Russia with 9. In this connection it might be remarked that the average displacement of all warships, excluding torpedo craft, has increased successively from 3,883 tons in 1899 to 4,131 in 1900, 4,416 in 1902, 4,725 in 1903, 5,010 in 1904, and 5,739 in 1905. This shows an increase of 48 per cent in six years, which is accounted for partly by an increased size of warships built and partly by the "scrapping" of old style ships, usually of small size. By this latter process England has brought her average displacement in the last year from 6,293 tons to 9,073 tons.—Iron Age.

The Year's Nobel Prizes.

The Nobel prizes were distributed on December 10 by King Oscar of Sweden. The recipients were:

In physics, Prof. Lenard, of Kiel University, for researches into cathode rays; in chemistry, Adolph von Böyer, professor at the University of Munich, for researches relating to the evolution of organic chemistry and the development of the chemical industry; in medicine, Prof. Robert Koch, of Berlin, for researches looking to the prevention of tuberculosis; and in literature, Henryk Sienkicwics, the Polish novelist. Baroness von Sutter, of Austria, was adjudged the winner of the Nobel Peace Prize. The Baroness for many years has been prominent in international movements looking to the peace of the world. She was one of the Austrian delegates to the International Peace Congress held at Boston last year.

Continued prosperity in the United States is having a marked effect on immigration. For the year ending June 30, 1905, the total was 1,027,421—the first year in which a full million was exceeded.

THE GAS PRODUCER FOR HEATING PROCESSES.

(*Continued from page 504.*)

this producer, the ashes being held in a large basin of water, which forms an effectual seal, preventing the generated gases from escaping. A steam blower creates an artificial draft for burning the coal, and at the same time sends in enough steam to enrich the gas, keep down the temperature of the fire, and soften the clinkers. The quantity of gas made is accurately controlled by the amount of steam turned on the blower.

On top of the producer is located a water-sealed automatic feed, for spreading the coal evenly and regularly over the entire burning area. Upon the continuous and accurate operation of this feed a large measure of the success of the producer depends.

It is obvious that if the fuel bed can always be kept in the same condition as regards temperature, depth and density, the gas produced will be constantly uniform. The paramount factors in maintaining uniform conditions in the fuel bed are first, the constant and even feeding in and spreading of the coal; second, the constant and even agitation of the fuel and ash bed; third, the constant and even removal of the ashes; and fourth, the even blowing of the entire fuel bed.

The quality of the gas, the perfection of the producer, and the economy of its operation depend almost entirely upon the degree of efficiency attained in these four operations.

With this end in view three at least of our leading manufacturers are spending considerable money in extensive experimenting. One of them is now offering a producer that, it is claimed, will perform all of these vital operations automatically and hence with a degree of perfection quite beyond anything heretofore obtained. In the ordinary old type of producer, the coal is hand fed and hand spread (if spread at all), the fuel and ash beds are hand poked every few hours (depending upon the faithfulness of the operator), the ashes are removed every 24 to 36 hours, and the blower hood is so designed as to make an even distribution of air throughout the producer impossible.

With our best producers, however, even though they are but partially automatic, great economies in numerous industries have been effected—the fuel bill often being cut down one-half and the capacity increased one-third.

How are such economies possible?

In the first place, in direct firing with solid fuel, combustion is always imperfect, often over fifty per cent of the energy of the coal passing up the chimney in the form of incompletely burned gas and heat to create the necessary draft. Accompanying this is the indrawing of a large excess of cold air through the grates, "to make the fire burn." Then there is a waste of coal through the grates with the ashes; the loss by radiation is very large, and finally, in applying the heat, it is usually impossible to distribute it to the exact places where required.

In the second place, the labor necessary for handling the coal at the various furnaces is a costly item.

In the third place, a direct coal fire is difficult to control; at times more heat will be produced than can be utilized, while at other times the heat will fall far short of the required amount.

Finally, whenever a plant is shut down, whether every night, only for an hour, or for a day or two, there is always a great waste in banking the fires and firing up again.

Contrast this with the conditions when a modern gas producer is used.

In the first place, in a properly-arranged gas furnace there is perfect combustion, so that small allowance need be made for loss of fuel value. This is a noteworthy fact, and calls for emphasis. All the coal put into a good gas producer is wholly converted into gas and ashes, so that all available heat in the coal is utilized, except a small radiation loss. Moreover, the air used for combustion is not cold, but is already raised to a high temperature by means of regenerators, which thus conserve nearly all of the otherwise wasted heat of the furnaces. In the case of melting furnaces, this feature alone means a saving of 50 per cent. There is, then, no loss of coal through the grates, and the heat lost by radiation from the producer and flues is a very small item. Moreover, the heat from the burning gas may be applied at the very point where needed.

In the second place, the coal is all received and handled at one point, thus greatly reducing the labor bill.

In the third place, a producer-gas fire is always under perfect control, allowing accurate regulation of the heat to meet the changing requirements of the furnace.

Finally, if the plant is shut down over night, or even over Sunday, there is practically no loss. It takes but a few minutes to get up the required amount of heat, even when the producer has been idle for two or three days.

But what are some of the figures gained by actual working experience?

In rolling mills with direct firing, about 300 pounds of coal per gross ton of finished product are required in the heating furnaces; with producer gas, only 122 to 150 pounds are needed.

In melting glass under the old method, one pound of coal was required for each pound of glass; with producer gas, the same results are obtained with one-half pound of coal per pound of glass.

Formerly, in steel works one ton of coal was consumed in melting one ton of iron, and 1,500 pounds of coal per ton of iron are still required with direct coal firing. With producer gas, but 600 to 800 pounds of coal per ton of iron are needed.

But fuel economy is not the only advantage to be derived from producer gas. Its use often greatly increases the output of a given plant, and provides facilities for accomplishing results that would be impossible with solid fuel.

A producer has recently been installed for lime burning, resulting in an increased capacity of 30 per cent and a decrease in the cost of fuel of 38 per cent.

The comparison of producer gas with other forms of fuel is easily made.

In the manufacture of illuminating gas, a large amount of waste is unavoidable, and it is necessary to make a certain proportion of by-product, or oil must be used for enrichment. This practically puts illuminating gas entirely out of consideration.

In the limited regions where natural gas is very cheap—say, 5¼ to 6½ cents per 1,000 feet—coal must be low in price—$0.75 to $1 per ton—in order that producer gas may successfully compete with natural gas. But since slack coal can be used advantageously in the best producers, it is not an impossible proposition even in the natural gas regions.

If oil and producer gas could be fired with equal economy, then oil at one cent a gallon would be as cheap a fuel as producer gas made from coal at $1 per ton; at $2 per ton for coal, the value of oil would be 1.7 cents per gallon. But oil, as a rule, cannot be fired with more than one-half the economy of producer gas; hence, producer gas made from coal at $2 per ton would be as economical as oil at one cent per gallon. The present price of fuel oil in the neighborhood of New York city is from 3 cents to 5 cents per gallon.

From these figures, the manufacturer can easily decide which fuel would be most economical for him in his locality.

The following is but a partial list of the many lines of business to which producer gas is being adapted with marked economy, and usually with largely increased capacities: Heating iron and steel in rolling mills and steel works of all descriptions; smelting and refining zinc, lead, copper, and all metalliferous ores; manufacturing lime, sewer pipe, pottery, brick, etc.; in chemical works, for heating the retorts, stills, roasting floors, boiling kettles, and evaporating pans; in enameling and japanning ovens, paint works, etc.; for heating and welding in locomotive works, boiler works, pipe mills, variety iron works, and railroad repair shops; in brass and copper mills, plate mills, malleable iron works; in spring works; in ore roasting and the manufacture of phosphates, soda ash, carbons, etc.; in sugar refineries, ship-building establishments, the manufacture of carriages, and the making of glass.

From a position of relative unimportance, the gas producer is thus being brought to a high state of efficiency, and shows itself to be of such value in so many lines of manufacture, that it would be hard to find a subject of wider or more practical interest.

The Current Supplement.

An article on the excavations of Delphi by the Paris correspondent of the Scientific American, splendidly illustrated, opens the current Supplement, No. 1564. Among the articles of practical interest may be mentioned one on Amalgams; Their Composition, Properties, Preparation, and Uses, and another on Old-Fashioned Weather Glasses. John Richards' article on simple steam turbine engines is concluded. Louis A. Hicks writes instructively on reinforced concrete construction. Rough casting, or as it is sometimes called, slap-dashing, is made the subject of a good article. Despite the improvements made in recent years in apparatus for saving life and making respiration possible in mines and conflagrations in general, the number of lives saved by the use of such apparatus is lamentably small. A new type of respiration apparatus, which is supposed to overcome many of the difficulties experienced heretofore, is called the pneumatogen, which is the invention of mining experts. This apparatus is exhaustively described. S. F. Emmons continues his historical review of the theories of ore deposition. One of the most thorough tests of the Edison iron-nickel accumulator that has ever been made was conducted by the well-known electrical engineer M. U. Schoop. The results of his investigations are published, and constitute a most valuable contribution to the literature of the storage battery. The usual Science Notes and Trade Notes are also published.

Correspondence.

Observations of Sunspots.

To the Editor of the Scientific American:

In reference to your article about sunspots in a recent number of the Scientific American, the following may be of some interest.

On the afternoon of Sunday, November 12, I happened to notice the sun as it was gradually sinking behind a hill. It was just enough obscured in haze, so that I could look at it without inconvenience. As I looked, a scarcely visible speck in the red orb of the sun caught my eye. I thought it was a delusion, but as I scrutinized the sun for fully five minutes and the speck remained, I realized that this insignificant dot was an immense sunspot. It was oblong in shape and about in the center of the sun's disk.

I watched the sun with much interest until it disappeared, for, in all probability, I will never again see a sunspot with my naked eyes. Irwin A. Hall.

Easthampton, Mass.

Preserve Niagara Falls.

To the Editor of the Scientific American:

I have just mailed a letter to our Congressman, Henry T. Rainey, urging him to give earnest aid to the restoration and preservation of Niagara Falls. Nothing would help more to convince the national Congress of the necessity of this work than a carefully and concisely prepared exhibit, showing the amount of water withdrawn from the Falls by the grants so far made.

Here in the West we believe that the power plants so far constructed should be condemned and settlement made with the corporations and after that Niagara River from Lake Erie to Ontario be converted into a public park for all time to come. Your articles published from time to time have been of great interest. Isn't it possible to prepare some sort of data covering this clearly and place it before each senator and representative? E. K. Blair.

Waverly, Ill., November 29, 1905.

Lubricating the Underwater Surface of Ships.

To the Editor of the Scientific American:

I would like a little space in your paper to put a few thoughts before those who may have an opportunity of testing them as to improvements in ships to make them get more quickly through the water. The friction between the sides of the ship and the sea must waste a great deal of power. The fish has a glutinous coating which I suppose lessens the clinging of the water to its surface. In many cases of friction the application of ball bearings reduces the power required otherwise to be used. An air bubble is a perfect sphere and if sufficient of them could be introduced at the lowest point upon the ship's surface they would act as friction rollers until the surface was reached.

It would be possible to use a pipe passing down the bow and along the keel, perforated with many holes, and supplied by a force pump with air. As the air escapes it will rise against the skin of the ship and follow to the surface, acting theoretically as friction rollers.

Or if a jet of kerosene oil was thus distributed it would kill the barnacles and growths that soon adhere to the iron, and make a coating that would answer for the fish's coat of slime. Two or three times a day would keep the surface oiled. D. B.

December 8, 1905.

A Panama Canal With Locks.

To the Editor of the Scientific American:

As another solution to the Panama Canal problem, I would suggest the following: First, build a lock canal; the locks to be built of steel, somewhat on the plan of a floating drydock, but having gates at each end. The under part of the locks to be caissons, such as used in bridge pier building. Thus, by using the well-known process of compressed air and undermining, the locks could be gradually sunk to sea level. Dredging could be carried on in all the different levels at the same time without interfering with traffic passing through the canal, the locks being removed as the different levels attain the desired depth. I should think locks 700 feet in length, 80 feet wide, and 65 feet in depth over the sill would accommodate the largest vessels that would probably pass through the canal before the sea-level depth was attained. I do not think such locks would be as expensive to construct as masonry ones would be, and after the completion of the canal they could be rebuilt into floating drydocks, or the material in them disposed of for other uses, thus saving a considerable expense.

By this plan, a lock canal could be built probably much quicker than by using masonry or concrete locks, and by the use of powerful dredges its transition to a sea-level one would be a matter of both less time and expense than by some others proposed.

Indiana, Pa., November 25, 1905. Edward Rowe.

THE TURBINES OF THE "CARMANIA."

The triple-screw turbine-driven steamship "Carmania," of the Cunard Line, which has recently completed its maiden voyage to New York, is a sister ship to the "Caronia," and identical with her in everything outside of the engine room. As we described the "Caronia" fully in our issue of March 11, 1905, when we gave illustrations of the passenger accommodation of the vessel, it will be sufficient for our present purpose to recapitulate briefly the leading dimensions and capacity of the new turbine liner.

The "Carmania," like the "Caronia," was built on the Clyde by Messrs. John Brown & Co., a firm which as long ago as 1867 built the "Russia," the first of the screw-propelled Cunarders to sail to the port of New York. The same firm has in hand one of the two 25-knot, 43,000-ton liners which are being built by the same company and will be placed in service early in 1907. The dimensions of the "Carmania" are as follows: Length on deck, 672 feet 6 inches; beam, 72 feet 6 inches; molded depth, 52 feet; depth from keel to roof of navigating bridge, 90 feet; depth from keel to top of funnel, 144 feet; depth from keel to top of masts, 205 feet. With full load the great ship draws 33 feet 3¼ inches and displaces 30,918 tons. She accommodates 300 first-class, 326 second-class, 1,000 third-class, and 1,000 steerage passengers. Add to this a complement of officers, engineers, and crew of 710, and we get a total of 3,336 souls that can be housed, fed, and comfortably transported. This is the population of many a thriving and well-equipped city in the United States that calls itself populous. In spite of the great displacement of these ships, they have a coefficient of fineness of less than 0.7. In the 25-knot ships the coefficient will be not very much over 0.5.

The sister ship "Caronia" was commenced and completed within the remarkably short time of nineteen and one-half months; the "Carmania," because of the novel conditions introduced by the installation of the turbine, took slightly longer. She was begun February 29, 1904, and launched February 21, 1905. In the construction of the "Carmania" 12,000 tons of steel and 1,800,000 rivets were required. Many of the plates are 1⅛ inch thick, 32 feet long, and 5½ feet in width. The keel plate is 5 feet deep and over 1 inch in thickness, and in the framing each fifth frame, in the machinery and boiler compartment, and each sixth frame forward and aft, is of web section, built up of ½-inch plates 30 inches in depth. The shell plating, for the most part, is 1 inch in thickness. The passenger accommodation is identical with that of the "Caronia," which has already been fully described in this journal.

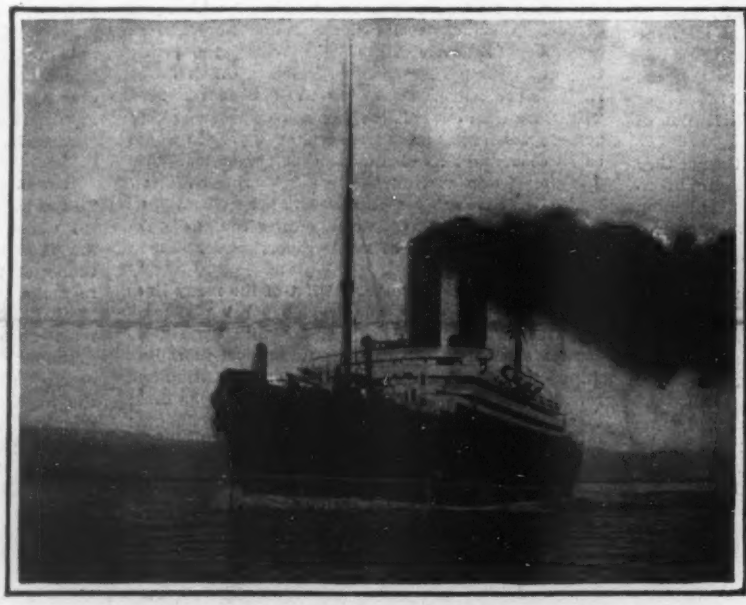
Interest in the "Carmania" centers, of course, in her engine room; for although the Allan Line steamships "Virginian" and "Victorian" have been running now for many months with turbine engines, the latter, are small compared with those of the new ships, being of about 10,000 horse-power, whereas those of the "Carmania" on the trial trip developed nearly 25,000 horse-power. The great size of the turbines, and the necessity of familiarizing the staff with their construction and operation, led the builders to make a set of three screw marine turbines of 8,000 horse-power. A shop was set apart as an experimental station, in which the turbines were erected together with a full equipment of condensers and auxiliary machinery. The turbines were coupled to dynamos whose efficiency had been accurately determined, and thus it was possible, during the many months that the plant was under test, to gather a large amount of most valuable turbine data. Experiments were also carried out to determine the best form of stiffening for the big turbine casings, to prevent distortion due to high-temperature steam. The result of the careful experimental investigation was shown in the very successful maiden trip to this port, on which the "Carmania" had to contend with extremely heavy gales for practically the whole voyage. As compared with the reciprocating engines of the "Caronia," it is found that there is a saving of weight in the turbines of about five per cent. This is very much less than has been popularly supposed, although engineers have well understood that the saving would not in the larger turbines reach a very high figure. In the "Caronia" the boiler pressure is 210 pounds, in the "Carmania" it is 195 pounds per square inch. Steam pressure at the engines is 200 pounds in the reciprocating engine, and 150 pounds in the turbines. To insure the full advantages in economy of the turbine, it is necessary to have a very high vacuum; and hence the 27,030 square feet of condensing surface in the "Caronia" is increased to 32,436 square feet in the "Carmania," while the capacity of the centrifugal pumps is increased 100 per cent.

The turbine machinery consists of three turbines, one to each propeller shaft. The high-pressure turbine is in the center, with a low-pressure turbine on each side of it. Adjoining each low-pressure turbine is a surface condenser. The high-pressure turbine is about 8 feet in diameter, and the low-pressure turbines are about 14 feet in diameter. The turbine blades, of which there are 2,115,000, vary in length from 2 to 10 inches. At the forward end of the low-pressure turbines, on the same shaft and within the same casing, are two turbines, or turbine rotors, for driving the ship astern. The total length of the combined ahead and astern turbines and their common casing is 36 feet.

From this description it will be seen that the turbine machinery of the "Carmania" is built on an imposing scale. In fact, the first impression, as one enters the engine room, is that he is facing three steam boilers, covered with Russia iron casing. As a matter of fact, the turbine equipment, with its necessarily large number of pumps and auxiliaries, occupies not much less space than the reciprocating engines of the "Caronia." The weight of each of the low-pressure turbines in the "Carmania" is 340 tons. The casings of the turbines are split longitudinally, and in order to lift the upper half for inspection, it has been necessary to install special lifting gear, which consists of a pair of massive crossheads, one at each end of the casing, to each of which is attached a heavy vertical screw, and worm-wheels and gear driven by an 18-horse-power motor. The total weight of the upper half of the low-pressure turbine casing is 98 tons, and of the high-pressure casing 45 tons. The starting platform is located at the forward end of the engine room, at about the level of the top of the turbine casings. The main throttle valve, which serves all three turbines, is shown in our illustration in the front of the platform, and in the center are shown two of the three sets of controlling levers, the center one being for the high-pressure turbine, and the two outer sets for the low-pressure turbines. High-pressure steam is admitted to the forward end of the high-pressure turbine and exhausts at the after end, from which it is led back into the forward end of the low-pressure turbine, and after passing through the blades, exhausts at their after end into the two condensers. The two go-astern turbines at the after end of the low pressures run normally *in vacuo*, and do no work. When running astern they are fed live steam direct from the main throttle.

Each of the three propellers is three-bladed, the blades being of the coarse pitch and large area which have been found best adapted for turbine service. They are only 14 feet in diameter, or say about 63 per cent of the diameter of the propellers of the "Caronia." They are driven at an average speed of 180 revolutions to the minute, which is by far the lowest propeller speed yet attempted with turbine engines. Except for their larger size, as described above, the condensers are of the ordinary cylindrical type. They are fitted with double-cylinder dry-air pumps, with a view to obtaining the fullest possible vacuum.

Governors are fitted to each of the turbines, and they are so adjusted that any increase beyond ten per cent in the revolutions of any of the turbines shuts off the steam until the revolutions fall to the normal speed. There is also an emergency governor provided, which entirely stops the turbines should any racing take place. We may mention in conclusion that should the "Carmania" be taken up by the British navy as an auxiliary cruiser, she would carry twelve quick-firing guns of large caliber. Moreover, two sets of steering gear are provided, one for ordinary navigation, and a duplicate set placed below the waterline, in agreement with Admiralty specifications.



Trial Speed, 20.5 knots. **Displacement,** 30,918 tons on 32 feet 3 inches draft.

THE NEW TRIPLE-SCREW, TURBINE LINER "CARMANIA."

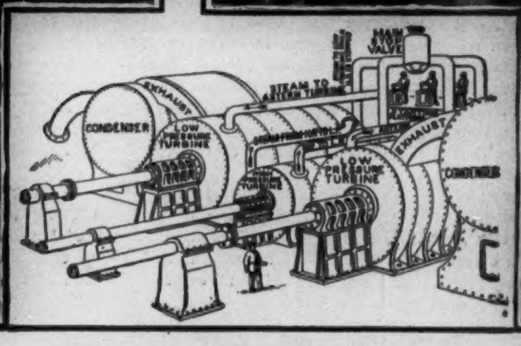
The Effect of Colored Light on Grain.

According to the experiments which have been recently made in France by J. Dumont, the different rays of the spectrum have a variable effect in the amount of nitrogen which is produced in the grains of plants, and this effect is strongly marked. Since the researches of Laurent, Marchal, and others, we are aware that light is necessary for the formation of albuminoids in the case of plants and the most refrangible rays are the most active in this respect. To show this action more clearly M. Dumont wished to observe the growing plants during the whole period of formation of the grains, after the flowering. He operates upon wheat which is cultivated in the vegetation boxes of the Grignon experimental farm. The plants grew under the best conditions, and were of regular growth at the beginning of the tests. As soon as the fecundation was accomplished he placed a series of box frames about the plants. The sides and the tops of the boxes were provided with colored glass. Means were provided for giving a good ventilation to the plants and prevent overheating. The surface of ground covered was about 800 square inches. Every week a number of heads were taken out so as to see the development. The wheat ripened normally in all cases, but it was found that the different colored glasses had a marked effect upon the composition of the grains, and the percentage of nitrogen and albumen which they contained. The colored glasses used were as follows: Blue, black (dark bistre), red, green, besides the free plants used as a check upon the results. The percentages of nitrogen in the grains corresponding to the above glasses are 2.13, 2.54, 1.91, 2.74, 2.08. For the albumen we have 13.31, 15.87, 11.94, 17.12, 13.00. The free plants given in the last figures show a normal constitution, while the differences are striking for the colored glasses. The green glass shows the highest percentage of nitrogen, or an excess of 66 per cent, then come the black, the blue and the red. These results show that the radiations which have the greatest effect upon the presence of the albuminoids in the wheat grain are those which act the least upon the chlorophylian function. All the tests were made with the same variety of wheat (Japhet wheat) and under identical conditions of soil and fertilizer, so that the results appear to be certain. We must not omit to state that all the grains were found to be formed as usual and their germinating power was not affected. Upon 100 plants, there were 92 germinations with the free plants, 94 with the black glass, 97 for the red and 99 for the blue and green. The author proposes to make further researches upon other plants.

Watt did not, of course, invent the steam engine, but he improved it so greatly as to become practically the father of modern steam engineering. He devised the separate condenser, the jacketing of the cylinder, the admission of steam to each side of the piston alternately, the steam-engine indicator, the ball governor, the poppet valve with beveled seat, the throttle valve, cross-heads and guides, the coupling of two engines together, and the water gage. He also suggested cut-off at quarter stroke as being the most economical. He found the steam engine of small power and limited usefulness owing to its disproportionate size and extraordinary consumption of fuel. He left it a complete machine, fit to be a potent element in the industrial development of the world.

This is the epitaph on Watt's monument in Westminster Abbey:

"Not to perpetuate a name, which must endure while the peaceful arts flourish, but to show that mankind have learnt to honor those who best deserve their gratitude, the king, his ministers, and many of the nobles and commoners of the realm raised this monument to James Watt, who, directing the force of an original genius, early exercised in philosophic research, to the improvement of the steam engine, enlarged the resources of his country, increased the power of man, and rose to an eminent place among the most illustrious followers of science and the real benefactors of the world. Born at Greenock, MDCCXXXVI. Died at Heathfield, in Staffordshire, MDCCCXIX."



Starting-Platform Showing Main Throttle and Turbine Control Levers.

Diagram Showing Arrangement of Turbines and Condensers.

Forward Bearing of High-Pressure Turbine Shaft.

View Looking Forward, Showing After End of Turbines, With Starboard Turbine 14-inch Shaft to the Right.

Forward End of Starboard Low-Pressure Turbine Showing Cross-Head and Guides for Lifting the Casing.

High-Pressure Propeller Shaft and After Face of High-Pressure and Port Low-Pressure Turbine.

THE TURBINES OF THE "CARMANIA."

SINGLE AND MULTIPLE ANIMALS.

BY J. CARTER BEARD.

It is quite natural for persons who have given no special thought to the subject to believe that it is impossible to breathe without lungs, feel without nerves, move without muscles, distinguish light from darkness without eyes, manifest any intelligence without a brain, eat without a mouth, and digest food without a stomach, and yet by far the greatest number of animals do all these things, besides producing young, quite as unfailingly as we ourselves do.

These unicellular organisms exist as separate and independent units of life in water, in blood, and in the intestines of animals.

Their number is indeed so enormously great, and their increase so rapid in sea water, that modern scientific writers upon the subject say that the basis of all life in the modern ocean is the micro-organisms of the surface. Modern microscopical research has shown that the one-celled plants and the one-celled organisms that feed upon them are so abundant and prolific, that they meet all demands and supply the food of all creatures that are used for food by all the larger forms of marine animals. The most completely representative form of the unicellular type is Amœba, a sort of a Diogenes among animals, that dispenses with every means possessed by other living creatures for performing the processes necessary for the life of an animal. Not only is this minute drop of that infinitely complex substance called protoplasm without parts or organs, but it has not even any proper shape, being continually changing its contour, and in the simplest varieties lacks what every other living product of nature possesses, some kind of a firmer external surface, crust, hide, or shell, as a protection from external injuries, so that it eats by pushing its semi-liquid substance against its food and immersing it in its body, and moves forward by protruding part or parts of itself and flowing into them.

It avoids obstacles and shuns strong lights in its progress, as if it had the use of eyes; it responds unmistakably to chemical or to mechanical stimulation, by means of which its movements may be checked or changed; in all of which it shows irritability, which is an unmistakable evidence of some sort of sensation.

Last, though by no means least, it absorbs oxygen and gives out carbon monoxide, which is, of course, nothing else but breathing.

But while such a large proportion of unicellular organisms live free and independent lives, others exist as component elements of higher unities, and as such constitute the multicellular and more complex plants and animals. In these the many-sidedness of function is lost, or at any rate in abeyance, and that in exact proportion to their degree of subordination. Certain sorts predominate in contractility, others in irritability, others in secretion, others again in storage, and so on. Thence arise muscle cells, nerve cells, glandular cells, fat cells, and the like.

But while this building up of animals from living cells has long commanded the study and the investigation of our greatest and most profound students of physiology, the development of composite animals from those so built up, compound aggregates of complex creatures, has not, the writer believes, received as a general subject any adequate attention from men of science.

The habits of certain social insects, ants, bees, and termites, tend to so intimate a relation of the members of one hill or hive as to suggest an organic whole governed by one intelligence or instinct, and composed of parts each of which is in turn made up of smaller units, and each of which has its special office to fulfill. Both bees and certain species of ants have the habit of temporarily clinging together in masses, forming one body of all the members of the community. The Suaba ant of South America collects in large globular masses when overtaken by a flood of water, and floats upon the surface. Belt tells us that he has seen temporary nests of this ant formed entirely of members of the community, in which were galleries and chambers where were sheltered the young and their attendants.

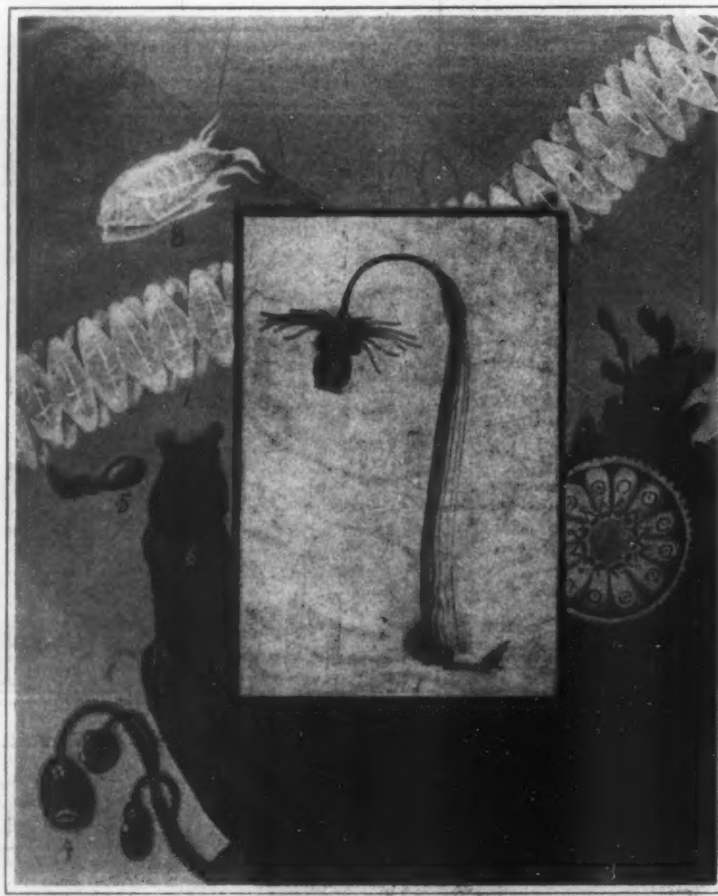
In examining the pebbles, seaweed, and other flotsam and jetsam left by the retreating tide, little globular bodies of a red or a yellow color may be often discerned, fastened to some sub-aquatic object, perhaps in a pool among the rocks. These bodies, one of which may be seen in Fig. 6, are furnished with two projections. Through one of these necks the sea squirt, as it is called, takes in water that after it has passed through the meshes lining the interior of the body, which strain out the minute creatures contained, is ejected from the other tube. The promptness with which these sack-like creatures spurt out the water inside of them, when they are touched, has given them their name of sea squirt.

Simple in structure and low in the scale of animated existence as sea squirts, or ascidians, appear to be, they are placed by systematic naturalists among the vertebrata, and have even a still lower tribe of creatures interposed between them and the invertebrates. As first observed by Kovalevsky in 1866, a number of species of this class of animals start out with a promise of reaching a point high in the ranks of living creatures, but afterward turn about and degenerate into an adult condition displaying very little, if any, resemblance to the vertebrates among which they began life.

The young sea squirt is not unlike the tadpole of a frog (see Fig. 5 in the illustration) being when it leaves the egg provided with a sort of backbone of gristle called a notochord, and above this a spinal cord, and possessing at the forward end of the bulbous-shaped body proper organs of hearing, sight, and so on, with a mouth, gill clefts, and a brain, and at the other a long tail with which to propel itself forward. If you happened to be unacquainted with its subsequent transformations, you might from its appearance fancy that it must develop into some kind of a backboned animal, as highly organized at least as say a frog. Instead of doing this, however, a complete retrogression soon sets in. Projections furnished with sucking disks grow from its body, which fasten it permanently to the first support it encounters; both head and tail disappear together with notochord, spinal cord, brain, and it becomes the mere leathery bag known as a sea squirt.

All sea squirts do not degenerate to such an extent, and even among those that do, a number of species exist during their whole lives as separate and distinct individuals. Others, however, although they resemble the solitary species in structure, are united as parts of a plant growing upon a stalk, as seen in *Boltenia pedunculata* (Fig. 4). Each individual has its own heart, respiratory system, and organs of nutrition, but is inseparably united. Following this in exhibiting a still closer inter-relation are the social sea squirts, in which the parent sends out a root-like process bearing upon its extremity an individual that in turn does the same, until a large colony is formed, consisting of sea squirts fixed upon bases or roots common to the whole group.

Attached to large stones or seaweed are often to be found translucent, jelly-like masses, investing whatever surrounds them with a glairy coat of various hues of orange, yellow, blue, purple, green, or gray. These things are as inert as are sponges, requiring a strong magnifying power to detect the currents of water that play about minute apertures in their surfaces; they belong to the group called compound sea squirts, in which the integument or skin, while common to all of the colony, is fused and united into a featureless envelope, inside of which are imbedded a number of sea squirts snuggled together about a cavity, into which the various ducts of their bodies open. If in our examination of one of these masses of gelatinous matter we cut it up, we find that the apparently single animal is really a commonwealth of individuals bound together by indissoluble and vital ties. Each of the starlike markings that appear is a family, each group of stars a community. Individuals are linked together into clusters, clusters are combined into systems. Each individual has its own life interests, but also must share in the operations which relate to the interests and well-being of the mass. Anatomical investigation alone can show us the wonderful inter-relation and the complexity of organism exhibited by these compound ascidians. A figure showing the regular forms often assumed by the animals in their grouping may be seen at Nos. 2 and 3 in the illustration. The most remarkable of the ascidians or sea squirts is without doubt the Salpa. These pelagic animals are as transparent as glass. Their structure and their life history are complicated. In the latter there is an alternation of generations. There are asexual forms or "nurses," from which there grows out a long ventral stolon or cord. This stolon is segmented into a chain of sexual buds, and the whole chain set free moves as one animal. (See Fig. 7 in the illustration.) As the individuals become mature they separate from each other, and we have the extraordinary spectacle of a compound organism breaking up into separate individuals. Each of these polyps produces an ovum, which after fertilization develops into an embryo and into an asexual form.



1. Typical hydroid, *Monocaulis pendula*. 2. Compound ascidian, *Botryllus*. 3. Compound ascidian, *Amarucium*. 4. Stalked ascidian, *Boltenia pedunculata*. 5. Tadpole of sea squirt. 6. *Mongula manhattensis*. 7. Chain of Salpa.

SINGLE AND MULTIPLE ANIMALS.

A Curious Industry.

Very often while the busy world is tearing along seeking fortunes in wide and well-known fields, hidden away quietly there is some modest little industry going along and bringing in a nice little sum to the sharp mind that has known how to seek wealth in untrodden or little-known paths. Among such out-of-the-way enterprises we may mention a curious agricultural industry which is being profitably carried on at Varedales, near Meaux, France. It consists in the manufacture of preserved sorrel, which is put up in tins or small casks, and exported to all parts of the world, for use as a culinary and table accessory. This industry was started at Varedales in the year 1860, but it still remains practically unknown to the world at large. It requires a motive power of about 8 horse-power while a quantity of steam (representing 17 horse-power) is also used for boiling and cooking purposes. As the water used must be extremely pure, an artesian well has been sunk in the grounds of the factory, and yields a supply of the necessary medium which, like the immortal Bayard, is "*sans reproche*."

Sorrel can only be grown four years in succession upon the same land, which must then be put under other crops for about twelve years. Hence the land bought up for the purpose covers a superficial area of 120 hectares (296 acres). When picked (for which sixty women are employed) the leaves are conveyed, as quickly as possible, to the factory; here they are carefully washed by mechanical means, and are then well cooked in specially-designed digesters or boilers. This interesting industry, which is by no means unprofitable, would well repay consideration, as there is plenty of room for a much larger trade to be done in preserved sorrel—by no means an unpalatable table adjunct.

Two steam turbine sets of 10,000 horse-power each are being installed at a Rhenish-Westphalian power station. They are the largest in Europe.

IS THERE LIFE ON THE MOON?

There was a time in the history of the earth when it had no satellite, when it was not the globe we know it now, but a great liquid planet incrusted by a shell some thirty-five miles in thickness. That time is separated from us by an interval which cannot be accurately determined, but which must be measured by millions of years at least. In those early days of its planetary career, the earth spun on its axis with a constantly-increasing swiftness that reduced the day to a few hours. When the period of revolution had finally dwindled to a bare three hours, a catastrophe occurred, one of the most fearful in all celestial history. Such was the enormity of the centrifugal force of the earth, that five thousand million cubic miles of its mass were hurled off into space. In that cataclysm our moon was born.

Strange as its origin may be, the moon has still other peculiarities to offer. It is the largest of all planetary satellites, so large indeed that to the inhabitants of a neighboring world it must appear with the earth as a marvelously beautiful double planet.

Because it is smaller in mass than the earth, the attraction of gravitation on the moon is considerably less than it is on the earth. If it were possible for one of us to journey to the moon and live there, we should find ourselves able to accomplish six times as much as we can on the earth. We could lift weights six times as heavy, run six times as fast, work six times as hard—all because the moon attracts bodies with but one-sixth the force of the earth. We could leap over barns with ease, and run a mile at express-train speed.

Despite the chasm of 253,000 miles that separates us from the moon, we know more of the physical characteristics of the single pallid face which it ever turns toward us than we do of the Arctic regions, or of the heart of Africa. We have studied, mapped, and photographed the great dark plains which were once thought to be seas and were accordingly miscalled "maria;" the lofty mountain ranges that sometimes tower 20,000 feet above the seas; and the vast, annular craters that pit the moon's aged features.

Although it once formed part of the earth, the moon is different from our globe in many respects. Charred by fires long since dead, honeycombed like a giant ball of slag, scarred by terrific volcanic upheavals, its telescopic aspect is anything but cheerful. Craters are not uncommon features of the earth; but on the moon their number and size are truly astonishing. At the lunar south pole these dead volcanoes are so closely packed together that to Galileo (the first man who ever saw the moon through a telescope) they seemed like the eyes of a peacock's tail. So large, indeed, are many of these craters, that a man standing within one of them would be unable to see the surrounding ramparts, because they would lie below his horizon. A diameter of ten, twenty, or even sixty miles is not infrequently met with in a lunar crater.

Are these craters all dead? Most astronomers believe so, but Prof. W. H. Pickering, of Harvard University, has recorded a number of observations that seem to point to the activity of a few of them at least. He relies chiefly on the fluctuations in size which have been observed in a comparatively small crater called Linné. On an old map one observer records Linné as a crater of moderate size. A century later it is described as a small, round, brilliant spot. When modern instruments of precision were invented the crater was measured repeatedly, with decidedly surprising results. Once its diameter was four miles; then it grew to six miles; and now it has shrunk to three-quarters of a mile. If this volcano is extinct, how comes it that it changes its size so strangely? Still another proof of activity is found by Prof. Pickering in the eccentricities of a gigantic crater called Plato, and in dense clouds of white vapor which have appeared before his eyes, rising from a tortuous cleft known as Schroeter's Valley. So minute have been Prof. Pickering's observations that their accuracy can not be seriously called into question.

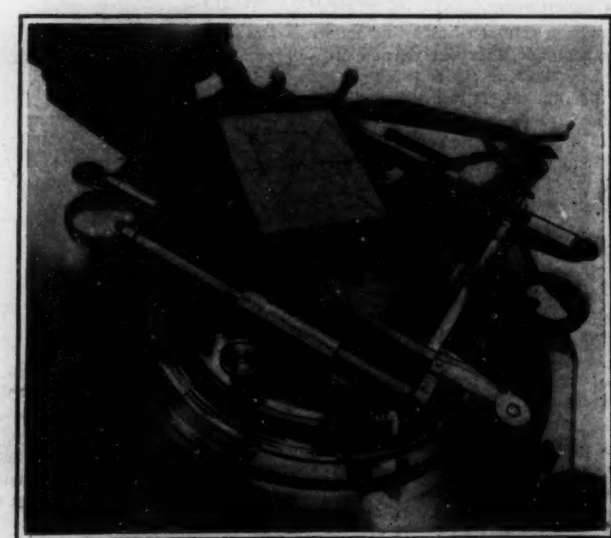
Granting that a few of the moon's craters are active, it follows that they must discharge something into space. That something, judged by our earthly volcanoes, must be water and carbonic acid gas. Because the pressure on the moon's surface is exceedingly low, and because the temperature during the long, cold lunar night is probably not far from 460 deg. F. below zero, water cannot possibly exist in the fluid state. Ice and snow are the only forms water can assume.

Is there any evidence of snow and ice? Almost every crater is lined with white. The lofty peaks of mountain ranges are hooded in white. At the South Pole the white glare is almost blinding. What is this white sheen? Merely the natural color of the moon's wrinkled face, according to most astronomers—snow and ice, forming where it should form, according to Prof. Pickering. The disappearance and reappearance of these white spots are admirably explained by this theory; for snow and ice would vaporize in the long lunar day—equal to fifteen of our days, and congeal again in white crystals as the sun set.

It has been said that an earthly volcano vomits carbonic acid. Conceding that a lunar crater ejects water in the form of a vapor and carbonic acid gas, is there any reason why life, in its lowest forms at least, may not exist on the moon? Prof. Pickering believes that he has discovered traces of vegetation. There are variable spots on the moon, spots that darken after sunrise and gradually disappear toward sunset. They are not shadows, for they are most pronounced when the sun is high in the heavens. They appear quickly at the equator, and encroach on the higher latitudes after a few days have elapsed. They are never seen in the polar regions. It is in these variable spots that Prof. Pickering has discovered what he considers to be vegetation. Whether he is right or wrong, this much is certain: He has explained with admirable simplicity a phenomenon that has long puzzled astronomers. To offset the objections that the temperature of the moon is too low to support organic life, it may be answered that certain lichens thrive in our own Arctic regions, where the temperature rarely rises above the melting point of ice. Moreover, many bacteria resist the most intense cold that we can produce. It may be objected that in a single day vegetation cannot grow appreciably; but on the moon a day is equal to fifteen of our days, and may well be likened to a miniature season.

The advances which have recently been made in selenography by Prof. Pickering show that although the moon is not a riotously luxuriant abode, it is anything but the lifeless orb commonly supposed. It may be desolate and cold; but it is not altogether dead.

THE BUILDING IN WHICH THE EQUATORIAL COUDÉ IS HOUSED.



PHOTOGRAPHIC MOUNTING OF THE EQUATORIAL.

A GLIMPSE OF THE GREAT TELESCOPE.

Effluviography.

The following translation of a communication on effluviology, or obtaining the photographic image by the electric effluvium (silent discharge), presented by the scientist Tomassi to the Académie des Sciences on March 22, 1886, ten years before the publication of Roentgen's memoir on the X-rays, may be read with interest by those who have not been familiar with the earlier researches:

I have the honor to submit to the judgment of the academy the first results of my researches on the method of obtaining by the sole action of the electric effluvium the effects realized by the employment of light in photography.

To photograph objects without the concurrence of light, or more exactly to effluviograph them, I have employed the following arrangement: Two metallic brushes, arranged parallel to each other, are connected with the battery of a Holtz machine. A gelatino-bromide plate of about the same height is placed perpendicularly to the brushes in such a way that the plane of the sensitive face embraces the borders of these brushes, or is very near them in both directions. When the current is established, a pose of a few minutes is sufficient. I have no need to record the fact that this operation should be conducted in complete darkness. There is then nothing further to do than to develop the image obtained and fix it by means of the ordinary processes. This experiment tends to prove that the effluvium produces the same effects as the ultraviolet rays, that consequently there must be a bond between the two extreme parts of the spectrum, and that this bond consists of what I will call provisionally, "electric rays."

To assure myself that the electric discharge contains other rays than the actinic rays, I have made the following experiment. I placed on a gelatino-bromide plate a piece of paper impressed as a negative. Then I put the whole in a frame. It was enveloped in such a way that, after a certain exposure to the light, no alteration was produced. I was then certain that the envelope was completely opaque; that is, that the protection against luminous rays was absolute.

Above the frames thus enveloped, I produced a series of silent electric discharges, of which the light could not influence the sensitive plate more than daylight. Yet an action was produced, and the image obtained, developed, and fixed was identical with that which the action of luminous rays would have given. It must therefore be concluded that electric light contains, besides the actinic rays, that particular class of rays which I have denominated "electric rays," and of which I have demonstrated the existence by making use of obscure discharges; that is to say, void of luminous rays.

Under the ordinary conditions of service, priming is produced by suspended matter in the boiler, and without regard to the amount of alkaline salts. The loss of water and heat through priming creates much danger in the boiler from the uncertainty of the height of the water and detracts from the power and efficiency of the locomotive.

Patent Department

A PORTABLE WATER HEATER.

A very simple portable water heater has recently been invented which is intended particularly for warming the water in a bathtub or a basin. The heater is arranged in the form of a float which floats on the water and can thus be moved around to different parts of the tub as desired. Our illustration shows the device heating a basinful of water. It consists of a copper shell or bowl fitted into a wooden ring. The latter affords sufficient buoyancy to float the device. A gas burner is supported on the float and consists of a pipe bent to project into the copper shell. The open end of this pipe terminates near the bottom of the bowl. At its outer end the pipe is formed with a number of perforations which permit an inflow of air to increase the temperature of the flame. The quantity of air admitted is governed by a sleeve on the pipe, which may be moved to cover any desired number of holes. A flexible tube connects the burner with a gas fixture. The flame of the burner is directed against the bottom of the copper bowl, heating the thin shell to a high degree of temperature. To confine the heat within the bowl, several rings of coiled wire are placed within, as indicated in the engraving. These coils effect a great saving of heat,

A PORTABLE WATER HEATER.

so that the water surrounding the heater is raised to a high temperature at an economical consumption of gas. The value of this device will be particularly felt in summer time when the cooking is done ordinarily on a small gas stove instead of a coal range, and it is consequently difficult to obtain a supply of hot water. With this novel heater a basinful of hot water may be obtained in a few moments and at short notice enough can be heated for the bath. A patent on this improved heater has just been procured by Mr. Charles M. Daly, of 538 West 29th Street, New York city.

A NOVEL SKETCHING DEVICE.

In the accompanying engraving we illustrate an excellent sketching device for the use of amateurs. Two forms of the invention are shown—one in which the drawing is made directly on the drawing surface, and

A NOVEL SKETCHING DEVICE.

the other in which a pantographic attachment is used. The latter is shown in the upper illustration. The device consists of a drawing board which may be fastened to the edge of a table by means of a clamp. Attached to the drawing board is a wire frame which, at its outer end, is bent into a ring to which the eye of the artist is applied. The pantographic device comprises a horizontal fixed rod which carries a metal plate. The plate is free to move laterally on this rod. The upper and lower corners of the plate are bent over to form bearings for a vertical rod. To the lower end of the vertical rod a pencil is attached and at the upper end a pointer is formed. The pointer and the pencil are thus given universal movement, and any outline traced by the former will be exactly followed by the latter. In order to make the pointer clearly visible to the eye, it is colored red or some other bright color. In use the artist rests his head against the eye frame, and looks through the eye piece at the object that is to be sketched, tracing its outline with the pointer as indicated by the dotted line in the illustration. This guides the movements of the pencil, causing the latter to reproduce on the drawing paper the image seen by the eye. The object may be drawn larger or smaller by moving it nearer to or further from the pointer. The second illustration shows the drawing board with the pantographic attachment removed. Secured to the upper end of the board is a piece of transparent fabric stretched tightly over a ring. In this instance the artist with his eye to the eye frame looks through the fabric at the object, and sketches directly on the fabric the image intercepted thereby. When completed the drawing may be transferred to a paper surface, or may be retained on the fabric, which, owing to its texture, gives a soft, pleasing effect. Mr. C. M. Daly, of 538 West 29th Street, New York, N. Y., is the inventor of this novel sketching apparatus.

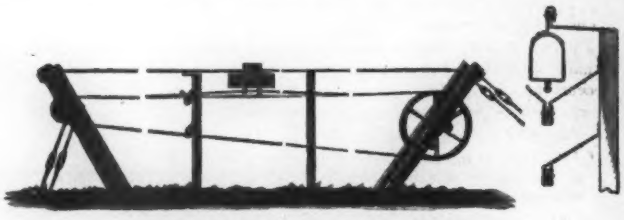
Brief Notes Concerning Patents.

A new enterprise now being launched in Texas, where it is said eight plants will be operated, is the manufacture of a new artificial fuel known as "carbonettes," which is really a compressed mixture of lignite, such as is found in abundance through Texas, and some of the cheap by-products of petroleum. It is very hard and said to be smokeless, odorless, and dustless and to have a calorific value equal to coal from the anthracite fields. In cost it is said to represent a great economy over coal, as it can be manufactured at and sold profitably at a price far below that of coal or wood. The principal of these plants will be established at Galveston, where it is expected to build up a large trade in supplying fuel for steamers.

Tobacco smoking is such a common habit that any novel way of providing a simple, inexpensive, and effective device, by which a cigar or cigarette may be quickly and conveniently lighted, is eagerly looked for. A recent invention has been patented, which may have some advantages. It is called a self-igniting cigar. The pointed end of a match is inserted in the outer end of a cigar. The match head extends slightly beyond a paraffine coating applied to the end of the cigar. A narrow band of paper is also added, for the purpose of protecting the cigar end from damage when striking the match. This wrapper projects beyond the end, and forms a flange and receptacle to contain the tip of paraffine. To light the cigar the match head is struck upon some rough surface until it ignites. This starts the paraffine, which in burning ignites the end of the cigar. The burning outlasts the match head, and produces sufficient flame. It is a question whether the mechanical aid this device affords will be offset by the impregnation of the weed with odors of burnt paraffin, the paper wrapper, and match—a combined scent likely to be much stronger than that of the ordinary match or light now in use.

SIMPLE MAIL-BOX DELIVERY DEVICE.

The establishment of the rural free-delivery system has created a demand for some convenient method for transferring mail from the mail box to the house, and *vice versa*, because these mail boxes must be situated along the public highway, which is often some distance from the house. One of the most recent inventions along this line is shown in the accompanying engraving. It consists in a mail box which is carried on a trolley wire, and may be moved along this wire to the roadside and back to the house, as desired. For purposes of illustration, only the two ends and an intermediate portion of the system are shown in the engraving. At the roadside a pulley is mounted between two posts which are imbedded in the ground, and an endless belt passing about this pulley extends to a point adjacent to the house, where it passes around another pulley mounted between a similar pair of posts. The latter pulley is shown at the right in the engraving. A number of posts are set up along the belt line, and carried in brackets fastened to these posts are a number of guide pulleys, which support the belt. A stationary trolley wire is stretched from end to end of the system, and is also supported by brackets on the posts. Traveling on this trolley wire is a sim-

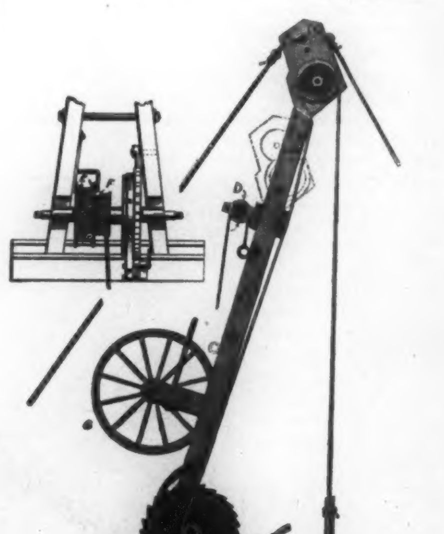


SIMPLE MAIL-BOX DELIVERY DEVICE.

ple carrier, in which the mail box is placed. The carrier is bent around the mail box and bolted to the endless belt, so that by turning the crank of the larger pulley, one can convey the mail in either direction along the trolley wire. Messrs. W. M. Shelton, C. B. Manning, and E. R. Cheney, of Gypsum, Kan., are the inventors of this improved mail-box delivery device.

PULLING MACHINE FOR OIL WELLS.

A patent has recently been granted to Messrs. William A. Worrell and Leslie Fish, of Van Buren, Ind., on an improved pulling machine for use in connection with the sinking and operation of oil wells. The principal objects of the invention are to provide a portable frame which can be readily taken from one well to another, with means for pulling and for lowering the rods and tubes and means also for simultaneously lowering a tube and raising another in position to be lowered into the well. Our illustration shows a longitudinal section through the machine which has been raised to operative position. The main frame, *A*, carries a movable extension, *B*, which normally occupies the position shown in broken lines, but may be extended to lift long pipes by means of a rope passing over the pulley, *D*. The latter is carried by the main frame and the screw eye to which the rope is attached is threaded into the extension beam. When raised, this beam is held by a bolt in the main frame, which engages a slot in the end of the beam. The machine



PULLING MACHINE FOR OIL WELLS.

is normally carried on wheels, *G*, but when in use is tipped up on end and supported by guy wires, as illustrated. The pipe is raised by a rope passing over the pulley, *C*, and attached to the drum shaft at the lower end of the main frame. This shaft carries a brake wheel and two cable drums, *E* and *F*. A metal band is passed around the brake wheel and may be tightened by depressing a lever. The cables on the drums, *E* and *F*, are preferably wound in opposite directions, so that the unwinding of one will wind up the other. A team of horses is attached to one of the cables, so as to turn the drum shaft and draw out the pipe. When a coupling is reached, this is uncoupled and the pipe is lowered to the ground under control of the brake. A pawl on the main frame engages a ratchet on the drum shaft and prevents the pipe from falling back into the well in case any of the cables breaks while the pipe is being raised.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

COMPOSITE INSULATOR.—L. Steinberger, New York, N. Y. Mr. Steinberger's invention relates to insulators and admits of general use, but applies more particularly to a type of composite insulator in which there are a plurality of hoods detachably connected together. Further, it relates to means for thorough insulation of the parts supporting these hoods and of the wires or cables to be supported by the insulator.

ELECTRIC-LIGHT HANGER.—H. R. Berry, Greenville, Miss. This improvement refers to means intended for hanging incandescent lights. The object is to construct a hanger of that general character which in addition to being adjustable, extensible, and made to effectively support the light as adjusted by improved means is inexpensive to manufacture and as an article neat in appearance.

Of Interest to Farmers.

LIQUID-AGITATOR.—A. Good, Claflin, Kan. The improvement of devices for agitating liquids for various purposes—such as mixing liquids, churning butter, etc., is the object of the inventor. It may also be used for aerating milk and other liquids. In operating upon some liquids the agitation required is quite great, while in others it is slight, and too great an agitation is objectionable. For this reason a relief-valve is used, and by means of it the pressure required for the particular liquid can be nicely adjusted.

COTTON CUPPER OR SPACER.—J. W. Gilleland, Athens, Ga. In this instance the object is to provide a new and improved cotton cupper or spacer designed to cup or protect the stand during the operation of cultivating and spacing the plants by covering up and arranged to leave the cotton-plants in a properly-cultivated state. The machine is very simple and durable in construction, and is not liable to get easily out of order.

SICKLE-HOLDER.—J. Walter, Yates Center, Kan. One purpose is to provide a device so constructed that the sickle-bar can be readily introduced, adjusted in the device and locked in adjusted position or removed therefrom, and further to provide a construction whereby the sickle-holder can be adjusted to any desired angle or to any bevel and can be vertically adjusted to accommodate it to any size of stone, and also moved forward and backward to impart the necessary movement to the knives over the grindstone.

MUZZLE.—F. M. Rowland, Webbers Falls, Ind. Ter. The invention is an improvement in muzzles for horses and horned cattle, and particularly in that class of muzzles which are composed of hinged sections that remain normally closed, but are caused to open automatically when the animal lowers his head, so as to cause certain portions of the muzzle to strike or press the ground, with the result that the animal may then graze without restraint.

Of General Interest.

A NAILLESS DEVICE FOR ATTACHING HORSESHOES.—J. D. W. Elliott, Toronto, Ontario, Canada. Referring to the article in our issue of December 2, introducing the above device to the notice of our readers, the inventors have drawn our attention to the fact that in the details contained in the article in question, we mention that the carrier is stamped out of ⅛ inch mild steel and leave the reader to conclude that the side bands and toe piece are left of that thickness. This is quite incorrect, the side bands, etc., being drawn out and fined down to give lightness and finish to the completed "carrier." Anyone wishing to obtain further information on the subject of this nailless horseshoe is requested to note that such information can now only be obtained by applying to Mr. J. D. W. Elliott, care of The Union Bank of Canada, Wellington Street, Toronto, Canada, Mr. Gibb having been called away to England.

BUTTON-CABINET.—I. Steinau, New York, N. Y. One of the purposes of this invention is to provide a cabinet adapted as a storage-receptacle for buttons of all descriptions, especially collar and cuff buttons, the cabinet being also provided with a display-compartment having spring-clamps for individual buttons of a series of buttons.

APPARATUS FOR FORMING CONCRETE WALLS.—C. E. Russell, Chicago, Ill. The apparatus comprises parallel boards spaced apart a distance corresponding to thickness of wall. Cross-bolts pass transversely through the boards at points above their lower edges, and nuts applied thereto, the bolts holding the boards detachably connected and yet adapted for adjustment toward and from each other, the hollow core-box having inner side open and arranged in contact with one of the boards, and a device attached to the upper side of box and engaging a pin set in the upper edge of board whereby the box is supported detachably and adapted for lateral adjustment with the boards as required for walls of different thicknesses.

TUBULAR WELL-PLUNGER.—E. R. Lockwood, Pratt, Kan. This invention pertains to improvements in tubular well-plungers, and the object of the inventor is to provide a simple device in connection with a plunger for raising and holding the valve open to permit water to pass through the plunger when it is withdrawn from the well-tube.

FLEXIBLE FABRIC AND PROCESS FOR MAKING SAME.—J. G. Jackson, New York, N. Y. This invention relates to the manufacture from silica, glass, or other fusible materials similar thereto of fabrics possessing considerable flexibility. More particularly relates to a flexible fabric suitable for use as substitute for solid glass and the like, and more especially for use as an electrical insulating material somewhat analogous to sheet-mica. More particularly relates to the manner in which fusible material when heated is drawn out so as to form sheets or films so thin as to be quite flexible and in building these thin sheets or films so as to form a laminated fabric.

JAR.—E. Houghton, Dalton, Ohio. In this instance the invention refers to jars of the kind used for containing butter and all kinds of goods usually shipped in jars, cans, or other analogous receptacles. It embraces quite a number of improvements in construction, and relates especially to means for closing the jar and for enabling a bail to be readily attached thereto, whereby the jar may be easily handled.

PIPE-BENDER.—S. M. Green and W. T. McFarland, New York, N. Y. The invention has reference to improvements in tools for bending pipe, the object being to provide a tool of this character having its head so shaped as to adapt the tool for bending pipe of different sizes without danger of kinking or flattening the same.

BIRD-KILLING DEVICE.—J. A. Beiersschmitt, Lester Township, Iowa. The object of the invention is to provide novel details of construction for a mechanical device which will stab and kill a bird that alights upon it, the device being adapted for dislodging the stricken bird and resetting its mechanism, so that it will kill a number of birds successively. It is intended for the destruction of crows, blackbirds, and sparrows, that commit depredations on fruit, garden stuff, and cereals.

ARCH-FILE.—E. M. Anderson, New York, N. Y. The invention relates to a means for filing loose leaves in book form, so that they may be convenient for observation and removal whenever desired, the device constituting what is commonly known as an "arch-file," owing to the employment of filing pins or rods of part-circular form.

PIPE-TONGS.—H. R. Hill, Caldwell, Ohio. This improvement pertains to pipe tongs or wrenches, and especially to such tongs as are used in oil regions for screwing and unscrewing sections of oil pipes or casings. The device is simple in construction and will operate to apply a powerful gripping force to the pipe when the lever of the tongs is used to produce the desired rotation of the pipe.

Household Utilities.

CURTAIN-POLE RING.—J. Kroder, New York, N. Y. The invention has reference to curtain-rings having anti-friction-rollers traveling on the curtain pole; and the object of the invention is to provide a new and improved curtain-pole ring which is simple and strong, cheap to manufacture, and arranged to securely hold the bearings for the anti-friction-rollers in proper position on the ring.

SHADE-BRACKET.—H. Kirchhofer, Parnassus, Pa. One purpose here is to provide a form of shade-bracket which can be secured to a window-casing at any convenient point between the longitudinal edges of the side members of the casing whether the shade to be hung has a longer or shorter roller than required for the window, thus not only enabling the brackets to be used in connection with different lengths of shade-rollers, but also enabling the brackets to be attached to the firmest portions of a casing to which brackets have been previously many times applied.

COMBINED HOLDER AND LOCKING DEVICE FOR WINDOW-SASHES.—D. G. Freeman, Canastota, N. Y. One object of the invention is to provide a device which may be set or adjusted to automatically engage and lock the sash to prevent either the lowering of the same after being raised or the raising thereof after being lowered, irrespective of the position originally occupied thereby. The device is capable of being applied for use in connection with window-frames and sashes as ordinarily constructed.

DUST-PAN ATTACHMENT FOR BROOMS.—L. B. Despain, Pacific Grove, Cal. The aim of the inventor is to produce a dust-pan attachment for a broom which can be readily applied to the broom and which may be operated readily to enable the dirt to be swept into the pan conveniently and without necessitating the sweeper to stoop closely over the dust-pan during the operation.

Machines and Mechanical Devices.

MINING-MACHINE.—W. H. Sexton, Sullivan, Ind. This machine properly placed with respect to the face of the coal, the motor is started, the clutches being in proper position to drive the carriage forward by means of the engagement of the gears and pinions. When the cut has been made to a sufficient depth, the machine is reversed by means of the clutches and the sliding frame is withdrawn and the machine is moved far enough to the side so that it will be in position for a second cutting. In providing active portion of chain-cutter with roller-support friction is reduced, while the rollers afford firm support for the back of the cutter.

APPARATUS FOR TESTING AND REGISTERING THE DEGREE OF INEQUALITY OF YARN, ETC.—R. Herzog, Erlach, Austria-Hungary. By means of this apparatus the degree of inequality of a cord—such as a thread, wire, or ribbon—or of a similarly-formed body may be measured and indicated, this indication being preferably registered by passing the cord between a relatively fixed surface and a movable surface, the movable surface being utilised to effect the measurement. The latter surface may be formed by a pendulum, which is caused by the inequalities of the cord to make corresponding movements and that can be used to produce the indication or registration.

ATTACHMENT FOR DREDGERS.—H. P. Francis, Oroville, Cal. Heretofore dredgers and especially those for taking sand from the sluices and depositing it upon the stacker ordinarily employed, have been supplied with sand-pumps which take sand and water from the sand-box directly to the tailing-pile. Water thus thrown on the pile washes the sand and gravel into the pond behind the boat and prevents proper piling up of material. These pumps are expensive to run, and to keep in repair. This inventor's purpose is to provide a device which will obviate the necessity for using these pumps.

HAT-MAKING MACHINE.—M. A. Cuming, New York, N. Y. The invention relates to hat-making machines and admits of general use, but relates especially to hat-making machines in which dies are employed for the purpose of forming bell-crown hats for ladies. By the means employed there is little or no probability of forming any creases, kinks, or folds in the hat material, as the same is fully expanded and not strained at any given point.

FILTER-PRESS.—R. Pick, Buffalo, N. Y. The object of this invention which relates to improvements in devices for filtering under pressure sugar-cane or beet-juice or other liquids, is to provide a filter by means of which the liquid may be rapidly and thoroughly filtered with a minimum quantity of water for washing and having high efficiency under comparatively low pressure, which permits the use of small pumps and a saving in the filter-cloth.

CASTING-BOX FOR STEREOTYPES.—F. Schreiner, Plainfield, N. J. The invention constitutes an improvement upon the device formerly patented by Mr. Schreiner in which he described a mold comprising a movable section-gage which enables plates of irregular dimensions to be cast in the same box. This invention provides a lifting device for the cover of such a casting box. Whatever be the width of the plate cast in the mold the lifting-bar will afford means for freeing the cover with facility, as the lifting-bar will always engage with the section-gage placed at any point.

MUSIC-LEAF TURNER.—R. C. Gallinant, Ridgefield Park, N. J., and J. Dukarevich, New York, N. Y. In this case the invention refers to improvements in devices for turning the leaves of bound music, the object being to provide a leaf-turner of simple and inexpensive construction and which may be conveniently operated by a musician without removing his hands from the instrument on which he may be playing.

Prime Movers and Their Accessories.

ROTARY ENGINE.—J. M. Ellsworth, New York, N. Y. The invention relates particularly to a rotary engine intended to be operated by steam or other elastic fluid, but by a change in the manner of operation the apparatus may be employed as a pump or compressor. In its preferred embodiment the apparatus comprises one or more circular cylinders, in which operate pistons intended to move continuously through the circular cylinder or cylinders around the common axis. These pistons are connected with the rotating element of the motor from which its power is taken, and co-acting with the cylinders are peculiar means for controlling steam supply and distribution.

Railways and Their Accessories.

CAR-FENDER.—J. J. Hoey, New York, N. Y. One purpose in this patent is to provide a fender capable of ready attachment to a car and in the construction of which complicated springs are not employed. Another is to provide a fender which will include a buffer of nested ring members of more or less yielding material, which will lighten the shock to a person or object struck, and also to provide a downwardly-extending apron at the end of the car, which apron normally closely approaches the road-bed and will remain in normal position under ordinary conditions, but which will yield rearward under impact and in so yielding will cause a scoop to drop and receive and retain the body.

RAIL-JOINT.—J. E. Alexander, Covington, Va. The novel features of this invention reside in a special form of one of the fish-plates which has an elongated lug that is received in a corresponding opening in the web of the rail; and a key that tapers longitudinally and has a dove-tail form in cross section, said key engaging between undercuts in the opposing portions of the fish-plates and a clamping chair in which the rail is seated.

CAR-FENDER.—W. G. Winans, Spokane, Wash. The invention pertains to improvements in car-fenders, being particularly adapted for use in connection with electric or other power-driven street cars. Mr. Winans has provided an extremely simple and efficient fender, one which can be instantly manipulated by the motorman and one in which the necessity for swinging out of the way at the end of the line is done away with. It can be drawn entirely under the platform of the car and housed to protect against the elements.

Pertaining to Recreation.

FIREARM.—E. B. Redfield, Glendale, Ore. The particular purpose here is to improve upon the magazine-rifle to the extent that a small-sized frame usually adapted to receive a short cartridge is made to receive a much longer one by reason of the finger-lever having a peculiar pivotal support with reference to the frame, which imparts a much greater throw to the breech-bolt than heretofore, the trigger remaining pivoted in the frame independent of connections between lever and frame. Means are also provided for preventing the bullet being battered, as when the point is marred it interferes with its accuracy in flight.

EXERCISING APPARATUS.—C. C. Percy, Rochester, N. Y. This is an improved exercising apparatus adapted for partial or complete suspension from any stable object having sufficient height and which will receive the hooks secured in an overhead stationary support. The apparatus is well adapted for convenient and safe use to strengthen the muscles of the upper portions of the human body, and the tension applied to the muscular system may be accurately graduated to suit the treatment appropriate for a patient, permitting the several details of the apparatus to be adjusted accurately for such a purpose.

Pertaining to Vehicles.

WHIP-HOLDER.—R. Schroeder, Morrisonville, Wis. The object in this invention is to provide a simple means for supporting and operating a whip so that it may be applied to draft-animals at too great a distance from the driver to be reached by the ordinary whip. The invention is especially applicable where lead-horses are used.

LOCKING DEVICE FOR BICYCLES.—E. F. Kaiser, Fresno, Cal. The invention has for its object to provide a locking device for bicycles or the like having novel simple details of construction which afford a very secure means for preventing the rotation of either the front or rear wheel of a bicycle, and thus render the bicycle useless as a vehicle until the device is unlocked with a suitable key.

LAMP OR HEADLIGHT FOR VEHICLES.—E. C. Geissenberger, New York, N. Y. One of the principal objects in this instance is to provide means whereby the light-rays emanating from the flame of the wick or burner of the lamp or headlight may be caused to be projected in the direction of travel of the machine, whether in a straight course or the turning of corners or rounding of curves, thereby lessening the danger of accidents and liability to collisions. The invention refers more especially to lamps or headlights for motor-vehicles, as automobiles and the like.

SPEED-INDICATOR.—H. Andrews, Hollis, District of Alaska. This invention pertains to improvements in devices for indicating the speed of bicycles, automobiles, racing-sulkies, and other vehicles, the object being to provide a device of this character that will be simple in construction, inexpensive, and that will accurately indicate the number of miles traveled per hour and the number of minutes per mile.

ADJUSTABLE SADDLE FOR HARNESS.—P. Y. Miller, Hermanville, Miss. As the contours of the backs of working animals vary, it is essential for the proper engagement of the harness-saddle that it be made adjustable, so that the pads of the saddle may be given a proper degree of divergence for comfortable engagement with the back whereon the harness is placed and avoid contact with the spine. This inventor provides details of construction which afford an adjustable saddle, simple, practical, and quickly adjusted automatically. Chafing and improper distribution of load strain is prevented.

WAGON-HOUND.—J. R. Davidson and B. C. Kelly, Monticello, Ga. It is the object of this invention to provide a hound in which the wood portion consists of straight strips, which are not easily broken, as there are no cross-grain curves, and if broken may be replaced at a comparatively small cost by either a wagonmaker or a person not skilled in the art.

METALLIC OVERSHOE FOR VEHICLE-WHEELS.—H. L. Canne, Dingman Township, Pa. The object of this invention which relates to automobiles, bicycles, and all other vehicles having wheels with solid or pneumatic tires, is to provide an improved metallic overshoe for vehicle-wheels, to increase their traction power without impairing the flexibility of the tires, to prevent undue wear of the tire and puncturing thereof, if pneumatic, and to prevent the wheels from skidding or slipping on wet or slippery roadways.

Designs.

DESIGN FOR A DISPLAY-CARD.—C. J. Steinau, New York, N. Y. This very attractive, unique, and effective ornamental design comprises a scroll-bordered card at the central bottom portion of which a collar button is prominently displayed. On each side of the

latter and mainly higher up is a celluloid tesselated panel for the purpose of holding the heads of a number of buttons for display.

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WANTED.—Interest in flourishing manufacturing business; or join with reliable party starting industry of merit. References of both must be satisfactory to each other. Every reply positively confidential. State nature of business. Address Flourishing, Box 773, N. Y.

Inquiry No. 7604.—For dealers in rare metals, such as platinum, etc.

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Inquiry No. 7605.—Wanted, printing wheel same size and character as used on a stock printer.

Inquiry No. 7606.—For manufacturers of celluloid watch cases.

Inquiry No. 7607.—For dealers in snakewood and boxwood in the log, and cut into pieces.

Inquiry No. 7608.—For manufacturers of experimental and electrical apparatus, such as lecture sets for schools and colleges.

Inquiry No. 7609.—For manufacturers of novelties, such as aluminum markers cut, pressed and enameled.

Inquiry No. 7610.—For manufacturers of case makers' canvas; also suitable cloths for box covering.

Inquiry No. 7611.—For manufacturers of box-making machinery, clasps and catches.

Inquiry No. 7612.—For manufacturers of a foot press for imprinting names on rubber holders and lead pencils.

Inquiry No. 7613.—For manufacturers of combination padlocks.

Inquiry No. 7614.—For manufacturers of drying machinery for fish products.

Inquiry No. 7615.—For manufacturers of machinery for heading square head machine bolts and carriage bolts, and for cutting and rolling threads for same; also machinery for punching and tapping nuts.

Inquiry No. 7616.—For manufacturers of glass balls and marbles, both in United States and Germany.

Inquiry No. 7617.—For manufacturers of steel tubing and materials suitable for aeroplane surfaces.

Inquiry No. 7618.—For manufacturers of induction coils.

Inquiry No. 7619.—Wanted, address of parties who bend sled runners.

Inquiry No. 7620.—For manufacturers of peppermint.

Inquiry No. 7621.—For manufacturers of nails, saws, wire, hinges; also cotton goods.

Inquiry No. 7622.—For manufacturers of ball bearings.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

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Minerals sent for examination should be distinctly marked or labeled.

(9857) R. D. F. asks: Would you kindly answer these questions? Why will a rainbow form a half-circle at sunset? Why does a rainbow usually show less than a half circle? Why would a bow form a complete circle seen from a balloon? A. A line drawn through the center of the sun and the eye of the observer passes through the center of the rainbow. This line is called the axis of the bow. An angle is formed with this line, the vertex of the angle being at the eye. At an angle of 40 degrees from this line in every direction violet may be seen, and at 42 degrees from this line red may be seen. It should be obvious that all the points which are at the same angle from the axis will lie on the circumference of a circle. The rainbow is for this reason a circular arc. When the sun is on the horizon, the axis will be in the horizon and a half circle is above the horizon whose other half is below the horizon. At sunset then a rainbow will be a half circle. If the sun is high in the heavens, the axis line will go below the surface of the earth before it reaches the horizon, and the part of the rainbow seen will be less than half a circle. If one is upon a mountain top, so that the axis extends far out above the horizon, more than half of the circle of the rainbow will be seen, and from a balloon it is possible to look down upon a cloud and see a circular rainbow, or the whole of the bow. Looking down upon the spray of Niagara Falls, one may see more than half a circle of a rainbow formed by the sun's rays in the gorge below.

(9858) W. W. asks: What is the scientific explanation of the fact that if an egg is held between the hands and compressed along its longitudinal axis, it is almost incapable of being crushed, while a pressure on a transverse axis readily accomplishes a contrary and expected result? A. The ends of an eggshell are domes, and are filled with an incompressible liquid. If these domes are fitted into the soft palms of the hands, and pressure evenly applied to the shell in the direction of its longitudinal axis, it will require considerable force to crush the shell. The liquid contents prevent the shell from collapsing inward; the soft palm prevents it from bursting outward. The part of the shell which is not covered by the hands is very nearly a cylinder, and although it is thin it has considerable strength to resist crushing.

(9859) A. E. S. asks: Kindly advise if an electric doorbell circuit can be formed with the ground and a single wire for a distance of two blocks. Also the formula for the solution of saltpeter used in destroying tree stumps by boring a hole and allowing the fluid to remain all winter, and in the spring pouring in kerosene and setting afire. A. An electric circuit can be completed through the earth for any purpose. Make a good ground at each end of the line in water or moist earth, and the bell will ring as well as if a return wire is used. There is no formula needed for using saltpeter on a tree stump. Bore deep holes in the stump, fill them with saltpeter and then with water, and plug the hole. This is done at any time. After six months or longer open the hole, fill it with kerosene oil, and set this on fire. The saltpeter causes the fire to smoulder in the wood.

(9860) R. R. asks: Will you please answer the following question in physics for me? What is the difference, if any, between "mass" and "weight"? For instance, what is the difference between 10 pounds mass and 10 pounds weight; or between 10 kilogrammes mass and 10 kilogrammes weight? A. The mass of a body is determined by the quantity of matter the body contains. Any body has an invariable mass. The weight of a body is not invariable but is affected by the force of gravity at the place of the body. The same mass, 10 pounds of lead, for example, will be the same all over the earth, but it will not weigh the same. It is customary to consider the unit of mass as the weight at a place where the intensity of gravity is unity. At Paris, France, the intensity of gravity is 980.96 cm. The weight of a body at Paris is then 980.96 times its mass. Mass is defined as weight divided by gravity; or weight at any place is its mass multiplied by gravity at that place. Gravity at Washington is 980.10.

NEW BOOKS, ETC.

THE PHYSICAL CONSTITUTION OF THE SUN. By William Appleby. San Francisco, Cal.: The Whitaker & Ray Company, 1905. 8vo.; pp. 510. Price, $4.50.

Mr. Appleby has a theory, and his theory, to use his own words, "has for its foundation one single act of nature, which is effected and completed by three laws. These three laws are: Impregnation, Fermentation, and Condensation; all other effects being subordinate to these or natural consequences thereof." From this it may be gleaned that the book does more credit to Mr. Appleby's vivid imagination than to his achievements as a scientist.

LEHRBUCH DER GEWERBE-HYGIENE. By Dr. Josef Rambousek. Vienna: A. Hartleben's Verlag, 1905. 8vo.; pp. 135.

The author's very practical book is divided into two main parts, the first of which is devoted to industrial hygiene, and the second to installations tending to improve the welfare of laborers. In this first division we find an elaborate discussion of ventilation of factories and workshops; disposal of refuse; injuries sustained by workmen due to improper regulation of temperature; bad illumination, overstraining of the muscles, and evil influences in general. In the second division excellent chapters will be found on workingmen's dwellings; hours of labor; division of labor; proper food of the laborer, and the proper care of the body.

SMOKE ABATEMENT. By William Nicholson. Philadelphia: J. B. Lippincott Company, 1905. 8vo.; pp. 256; 59 illustrations. Price, $2.

In the present volume the author has endeavored to give, as concisely as possible, an account of the smoke abatement movement, and to indicate the means by which the smoke nuisance may be combated. The author contends that so far from being a necessary evil, it is one that is easily remediable, and for the removal of which adequate machinery actually exists. Three chapters are given to the legal aspects of the subject. The leading types of the various appliances now on the market for the purposes of smoke abatement and fuel economy are illustrated and described.

THE PRINCIPAL PROFESSIONAL PAPERS OF DR. J. A. L. WADDELL, Civil Engineer. Edited by John Lyle Harrington, C.E. New York: V. H. Hewes, 1905. 8vo.; pp. 991.

This valuable collection of papers, by one of the foremost civil engineers of his day, represents some of his best literary work during a lengthy professional career. It is a fact well understood among the members of the profession that much of the most valuable published engineering data of a practical kind appears in the form of papers that are read at the meetings of engineering societies, or in the form of addresses delivered to engineering schools. Although many of these addresses appear in the printed proceedings of the engineering societies, there are others that never secure even that much permanent record. Moreover, the proceedings are generally only to be found in the possession of those who were members of the society at the time of publication. The information contained in such papers is of the kind that is gathered by the engineer after his graduation. Much of it is sought for in vain in the current text books, and it possesses a value that can only be fully appreciated when search has been made for it, often in vain, among the standard publications. It was considerations of this nature which led the editor to gather Mr. Waddell's papers into book form; and it is sufficient to say of its contents that their range of subjects is as wide as that of the experience of their gifted author. The work is beautifully printed, and is enriched with half-tones, line drawings, and an elaborate series of diagrams and statistical tables. Among other chapters may be mentioned Notes on Railroad Drainage, and General Notes on Railroading; four chapters on Civil Engineering Education; a chapter on the Compromise Standard System of Live Loads for Railway Bridges and the Equivalents for the Same; an excellent chapter of advice to the intending bridge engineer as to the best way to furnish himself, after graduation, with the necessary experience to render him a competent consulting bridge engineer. One of the most lengthy and important chapters is an elaborate discussion of the design and construction of elevated railroads.

GEOLOGY OF WESTERN ORE DEPOSITS. By Arthur Lakes. Denver, Col.: The Kendrick Book and Stationery Company, 1905. 12mo.; pp. 415. Price, $2.50 net.

This is the second edition of a meritorious book. The author is a well-known geologist. The clear style in which the book is written will make it easier for miners to understand. Every prospector should have a copy. A marked feature of the book is its copious illustration.

RAFTER AND BRACE TABLES. By H. J. Aurlie. New York: Industrial Publication Company. N. D. 18mo.; pp. 29.

METHODS OF CHEMICAL CONTROL IN CANE SUGAR FACTORIES. By H. C. Prinsen Gierligs. Manchester, England: Norman Rodger, 1905. 8vo.; pp. 85. Price, $1.40.

THE HONORABLE PETER WHITE. A Biographical Sketch of the Lake Superior Iron Country. By Ralph D. Williams. Cleveland: Penton Publishing Company. N. D. 8vo., pp. 205.

THE EXPERIMENTAL BACTERIAL TREATMENT OF LONDON SEWAGE. Being an Account of the Experiments Carried out by the London County Council between the years 1892 and 1903. By Prof. Frank Clowes, D.Sc. (Lond.), F.I.C., Chemist to the Council, and A. C. Houston, M.B., D.Sc. London: Printed by James Truscott & Son. 8vo.; pp. 242. Price, $4.

MATTONI E PIETRE DI SABBIA E CALCE. By E. Stoeffler. Milan: Ulrico Hoepli, 1905. 32mo.; pp. 232.

CONTI E CALCOLI FATTI. By Italo Ghersi. Milan: Ulrico Hoepli, 1904. 32mo.; pp. 191.

INDEX OF INVENTIONS

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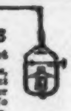

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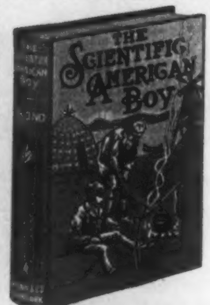

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Switch or signal apparatus, F. L. Young... 806,948
Switch signal, J. C. Wigman 807,053
Table, J. L. Newell 806,907
Tacking machine, H. H. Cummings........ 807,111
Tanning vat, R. Koenitzer 806,899
Target trap, J. H. Brookman........ 806,773
Target trap attachment, J. Kautsky........ 806,897
Teat cup, pneumatic, A. Gillies........ 807,372
Telegraph circuits, double jack for, O. Johnson 806,812
Telegraph line wires, adjustable support for, J. N. Bell 806,769
Telegraph repeater, Greene & Gaunt........ 806,801
Telegraph system, wireless, L. De Forest.. 806,966
Telegraphic apparatus, Hawley & Rhoads.. 806,891
Telegraphic repeater, S. D. Field........ 806,884
Telephone bracket, H. F. Foersterling...... 806,790
Telephone selective system, party line, W. M. Bruce, Jr. 806,950
Telephonic system, R. H. Polk........ 807,316
Tellurian, J. E. Rempe 806,839
Tent, H. L. Gulline 806,802
Textile machinery, electric stop motion for, J. B. Whitney, reissue 12,423
Textile machinery, electrical stop motion mechanism for, J. B. Whitney, reissue. 12,422
Ticket holder, R. H. Mallory........ 806,985
Ticket separating machine, W. A. Gibbs.... 806,969
Tickets, etc., machine for separating, W. A. Gibbs 806,968
Tiling, F. C. Millhoff 807,083
Time lock, electric, J. T. Van Dillen...... 806,942
Tire and means for securing same in place, resilient, W. F. Beasley 807,350
Tire attachment, wheel, J. F. Horn........ 806,810
Tire, bicycle, L. W. Groat........ 807,073
Tire charging valves, coupling for, G. W. Kellogg 807,032
Tire plug, F. B. Parks........ 807,087
Tire, pneumatic, J. H. Bleoo 807,351
Tire, vehicle, R. B. Parker........ 807,311
Tires, chain armor for pneumatic, E. B. Hazleton 807,167
Tool, combination, E. Hogan 807,382
Tool handle, pneumatic, W. H. Keller...... 807,384
Tool holder and tool, C. W. Grant........ 807,166
Torpedo, automotor, Noalhat & Fournier... 807,195
Toy, L. E. Bergensten 807,237
Toy elevator, W. H. Smith........ 806,930
Toy fire engine, H. T. Kingsbury........ 806,983
Toy, inertia wheel, H. T. Kingsbury, 806,977, 806,978, 806,980, 906,979, 806,981
Toy vehicle wheel, D. P. Clark........ 806,872
Toy, wheeled, H. N. Parker........ 806,982
Trace hook, J. T. Scogin........ 806,925
Trace splice, H. Breiding 807,058
Track alining apparatus, Shaw & Eberle... 807,208
Traction towing, gripper mechanism for, P. Thompson 807,218
Train order holding device, W. W. Ayres.. 807,234
Trap, R. L. Stringfellow 806,936
Trap joint, C. H. Muckenhirn........ 807,304
Tree felling footboard, Evans & Caron..... 806,963
Tree protector, Staley & Ward 807,213
Tripod head, G. J. Hoelzer........ 807,078
Trolley contact, I. J. Bradshaw........ 806,867
Turbine, D. W. Starrett 806,934
Turbine, elastic fluid, G. Westinghouse, 806,977 to 806,981
Turbine, steam, J. F. Brady........ 807,057
Typewriter desk, W. F. Fraser........ 806,792
Typewriters, paper and envelop feeding attachment for, S. D. Ruth........ 807,321
Typewriting machine, M. W. Pool........ 806,834
Typewriting machine carriage bearing, E. G. Latta 807,292
Typewriting machine word registering attachment, R. R. Fowler 807,022
Typewriting, manifolding sheet for, Mathews & Van Holland 806,818
Umbrella stick and cane, J. & H. Landes.. 807,035
Vaginal glass applicator, M. B. Pearlstein. 807,124
Valve and stop valve, combined throttle, G. R. Smith 806,929
Valve for train pipes, steam, E. E. Gold... 806,970
Valve, reducing, H. L. Harbaugh........ 807,074
Vapor used in the destruction of weeds and rabbits, apparatus for generating, B. Locking 807,180
Vapors of volatile solvents, apparatus for recovering, E. Bouchaud-Praceiq 806,866
Vat. See Tanning vat.
Vehicle brake, J. Curry 806,957
Vehicle hitching attachment, Plato & Kilgore 807,047
Vehicle, motor, T. Stafford 806,933
Vehicle, motor propelled, E. S. Clark...... 807,419
Vehicles, egg case carrying attachment for, R. N. Story 807,138
Vending machine, F. E. MacCordy........ 807,183
Vending machine, A. T. Hallock........ 807,376
Vessel cap, J. M. Hicks 807,077, 807,115
Vise, Perron & Jeffs 807,315
Wad sorting machine, W. L. Morris........ 807,185
Wagon body lifter, J. H. Simonton........ 807,324
Wagon brake, E. B. Rose........ 806,843
Wagon hound, R. T. Petrich........ 806,993
Wagon side-board, J. J. Coyle........ 807,300
Wall covering, T. Cleary 807,155
Wall coverings, machine for producing plush effects on, T. Cleary 807,154
Wall coverings, manufacture of, T. Cleary. 807,357
Wardrobes, clothing support for, L. Gallot. 807,259
Wardrobes, movable support for, L. Gallot. 807,260
Washboiler attachment, S. J. Gibson........ 807,371
Washing machine, M. L. Winegarden...... 807,007
Watches, cannon pinion for, L. A. Faller.. 806,964
Water bag, A. C. Eggers........ 807,365
Water closet and seat therefor, C. H. Muckenhirn 807,305
Water heater, R. J. Hutchins........ 807,030
Water jacket, C. W. Hawkes........ 807,076
Water meter, C. F. Drake........ 806,961
Water motor, P. T. Coffield........ 806,779
Water or impact motor, B. H. Divine...... 806,785
Water, purifying, J. F. Wixford...807,008, 807,412
Water wheel, A. C. Mather........ 806,817
Water wheel, O. H. Nordstrom 806,990
Whiffletree hook, J. Stahl 807,212
Winding machine, A. D. Scott........ 807,133
Windlass, friction, W. J. Nelson........ 807,192
Window fixture, J. E. Woods........ 807,101
Window fixture, W. S. Cooper........ 807,108
Window screen and guard, A. Johnston.... 807,276
Wire cutting device, J. B. Foote........ 806,791
Wire fabric, H. Richardson 807,400
Wire stretcher, W. A. Steere........ 807,331
Wire stretcher clamp, D. H. Parker........ 807,200
Wood, apparatus for forcing fluids into, S. Willner 807,411
Wrench, E. R. Klemm 806,815
Wrench, J. H. Shepherd 807,209
Wrench, H. L. Newton 807,396

DESIGNS.

Badge, Tuckey & Kline 37,720
Bonbon dish, C. A. Bennett........ 37,726
Carriage, C. Kramer 37,731
Coffee pot, C. A. Bennett........ 37,728
Fabric, printed textile, E. B. Vandergaw, 37,732 to 37,734
Gate, J. H. Wheelock 37,730
Mirror or similar article, hand, S. A. Keller. 37,723
Paste jar, J. A. Larrabee........ 37,729
Pen holder and tray, fountain, M. A. Bensiger 37,722
Ring, A. A. Dorst 37,721
Salt or pepper pot, C. A. Bennett........ 37,727
Spoon, E. F. Rueckert 37,724
Spoon or fork, C. A. Bennett........ 37,725

TRADE MARKS.

Ale, Adam Scheidt Brewing Co........ 48,147
Baking powder, J. C. Grant Chemical Co.... 48,155
Beef extracts, bouillon, and beef tea, Cudahy Packing Co. 47,141
Beer, lager, Adam Scheidt Brewing Co..... 47,148
Beer, lager, V. Neustadtl 48,160
Bells, church and school, C. S. Bell Co...... 48,114
Belt dressing, New York Leather Belting Co. 48,110

Belting, leather, Graton & Knight Manufacturing Co. 48,115
Bits, stirrups, spurs, and harness buckles, Smith-Worthington Co. 48,094
Bitters, stomach, P. J. Bowlin Liquor Co. 48,164
Boots and shoes, elastic pads and cushions for the bottoms of, Tredair Rubber Co. 48,116
Boots and shoes, leather, Jenkins Bros. Shoe Co. 48,156
Boots, shoes, and slippers and upper and sole leather, leather, Packard & Field 48,090
Boots, shoes, and slippers, leather and leather and cloth, G. F. Daniels & Co. 48,087
Brandy, P. J. Bowlin Liquor Co. 48,181
Brandy, Wm. Bergenthal Co. 48,192
Brooms, H. Thompson 48,171
Brushes, paint, E. Clinton & Co. 48,152
Brushes, varnish and paint, E. Clinton & Co. 48,120
Buckets, well, Prewitt-Spurr Manufacturing Co. 48,112
Buffing compounds, George Zucker Co. 48,143
Cake and ice cream cones made from cake, Hazelwood Company 48,127
Candles, E. Schneider & Co. 48,124
Candy, penny, New England Confectionery Co. 48,161
Cards, playing, A. O. Leonard 48,158
Cards, playing, New York Consolidated Card Co. 48,170
Chains and lockets, Bassett Jewelry Co. 48,168
Cheese, Hazelwood Co. 48,128
Cigars and cheroots, Filogamo & Alvarez 48,125
Coats, pants, and vests, men's and boys', Reinhard, Meyer & Co. 48,138
Coffee, Geiger Tinney Co. 48,142
Coffee, cereal, Sleepy Eye Milling Co. 48,167
Cologne spirits, Diamond Distilleries Co. 48,169
Cordials, A. Breslauer Co. 48,173
Corsets, corset waists, and corset steels, Kops Bros. 48,107
Cotton and part cotton piece goods, Smith, Hogg & Co. 48,091
Cotton flannel, Pemberton Co. 48,111
Cuffs, J. B. Boyle 48,119
Cure for abscesses in teeth, E. P. Rutherford 48,185
Dentifrice in powder, liquid, and paste form, tooth, Woodman-Davis Co. 48,194
Eggs, Hazelwood Co. 48,126
Fabric formed of woven splints, strips, or slats, and thread, cord, or wire for shades, screens, curtains, and the like, Hough Shade Corporation 48,088
Fabric, silk, Stewart Silk Co. 48,092
Fish, dried, smoked, pickled, salted, and canned, W. T. Shute 48,166
Flour, wheat, G. C. Christian & Co. 48,122
Flour, wheat, Acme Milling Co. 48,146
Flour, wheat, M. Alexander 48,150
Flour, wheat, G. C. Christian & Co. 48,151
Game, E. I. Horsman Co. 48,153
Gin, P. J. Bowlin Liquor Co. 48,182
Gloves, J. Adler & Co. 48,149
Guano, Tennessee Chemical Co. 48,093
Hats, hat frames, and hat trimmings, John Miles 48,131
Ice cream, Hazelwood Co. 48,130
Lard, Tennessee Packing and Provision Co. .. 48,140
Magazine or periodical, Homefolks Publishing Co. 48,154
Magazines, periodical, Doubleday, Page & Co. 48,096
Mattresses, T. B. Burnett 48,086
Mattresses, Foster-Allison Co. 48,104
Medicinal tablets, Antikamnia Chemical Co., 48,189 to 48,191
Medicine for cows, Dairy Association Co. 48,176
Medicine for the remedy of nervous debility, Ho Ly-Yuen 48,178
Medicines for the regulation of the liver and purification of the blood, A. H. Lewis Medicine Co. 48,188
Milk and cream, Hazelwood Co. 48,129
Molasses, N. W. Taussig Co. 48,136
Mustard, prepared, Joseph Campbell Co. 48,089
Nails, horse, Capewell Horse Nail Co. 48,113
Neckwear supporters, ladies', Blumenkrohn Crochet Button Works 48,118
Oils and greases, lubricating, A. W. Corning. 48,121
Ointment or salve, E. Schmidt & Co. 48,186
Paint, Nansen Composition and Paint Co. 48,135
Paste, Diamond Paste Co. 48,123
Pencils, lead, Eagle Pencil Co. .... 48,097 to 48,103
Pens, steel, Hall Bros. 48,105
Pipes and fittings, soil, Abendroth Bros. 48,145
Razors, Krusius Bros. 48,157
Remedy for certain named diseases, Patton-Worsham Drug Co. 48,180
Remedy in tablet form for colds, headache, and grip, Bromo Chemical Co. 48,174
Rings, Jones & Woodland 48,132
Roofing, ready tar and felt, Barrett Manufacturing Co. 48,117
Roofing slate, Slatington-Bangor Slate Syndicate 48,139
Rubber boots and shoes, Lambertville Rubber Co. 48,108, 48,109, 48,133
Rum, P. J. Bowlin Liquor Co. 48,163
Sheetings, Minot, Hooper & Co. 48,159
Silk crape, brilliant soft twisted, Hess, Goldsmith & Co. 48,106
Tobacco and cigarettes, smoking, Carreras Limited 48,095
Tonic, Voigt & Co. 48,193
Varnish and japan, Mayer & Loewenstein 48,179
Veterinary antiseptic remedy for screw worm, C. Robinson 48,183
Watch movements, Hampden Watch Co. 48,144
Whiskies, S. C. Herbst 48,177
Whisky, Morrin-Powers Merc. Co. 48,134
Whisky, T. Pepper's Sons 48,137, 48,162
Whisky, G. Rexinger 48,165
Whisky, A. Breslauer Co. 48,172
Whisky, I. Ciener 48,175
Whisky, R. M. Rose Co. 48,184
Whisky, T. H. Swan 48,187

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"Adirondack Line," for shoes, E. A. Quirl .. 12,550
"Car-Wi-Co. Georgia Syrup," for syrup, Cargill-Wight Co. 12,542
"Diamond Bar," for prunes, J. J. Shaner 12,545
"Durham," for cheese, S. Van Korngut 12,547
"Holstein," for cheese, S. Van Korngut 12,546
"Hosterman's Equine Invincible Healer," for ointment, J. H. Hosterman 12,543
"Ireno," for hair tonic, J. S. Riley 12,544
"Liebotschaner," for beer, Joliet Bottling Co. 12,541
"Puncture Cover," for cans, Wm. Underwood Co. 12,551
"Queen Aroma," for cigars, I. Delatisky & Son 12,540
"Seaborg's Silverside," for canned salmon, Seaborg Pkg. Co. 12,548
"Sparklingstone," for cigars, Goldberg & Finkelstein 12,539
"Taroena," for cooked flour made from the taro root, Taro Food Co. 12,549
"The American Bureau of Information," for publications relating to national industries, A. E. Horton 12,552

PRINTS.

"A Real American," for tobacco, Bloch Brothers Tobacco Co. 1,511
"Blanchite Process Paint," for preservative paints, composition coatings, enamels, and water paint, Blanchite Process Paint Co. 1,514
"Celebrated Curative Wine of Chensthow," for a wine, A. Skarzyunski & Co. 1,510
"Reuter's Soap," for soap, Barclay & Co. 1,512
"Say Jack—That's the Stuff that makes you feel like a horse," for stock food, Pratt Food Co. 1,513

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